230137
SEP 29 1891

THE AMERICAN GAS LIGHT JOURNAL

REDMAN & KENNY, N.Y.

PUBLISHING OFFICE No. 32 PINE STREET

DEVOTED TO THE INTERESTS OF ILLUMINATION, VENTILATION, WATER SUPPLY AND DISTRIBUTION, & GENERAL SCIENCE.

VOLUME LV.—No. 13. Whole No. 851. | NEW YORK, MONDAY, SEPTEMBER 28, 1891. | $3 PER ANNUM, IN ADVANCE.

A. M. CALLENDER & CO., Proprietors. C. E. SANDERSON, Manager.
JOS. R. THOMAS, C.E., Editor. T. J. CUNNINGHAM, Asst. Editor.

ENTERED AT THE POST OFFICE AT NEW YORK, N. Y. AS SECOND CLASS MATTER.

Published on each Monday of the year, at No. 32 Pine Street, N. Y.

Terms of Subscription, Including Postage.—For the United States and Canada, $3 per annum. European countries, $4.50 (19 shillings—22½ francs). All payments to be made in advance. Single copies, 10 cents.

Remittances should be made either by post-office order, express money order, registered letter, or bank draft on New York, payable to the order of A. M. Callender & Co.

Collections are invariably made directly from this office, for subscriptions, advertisements, etc. We have agents to solicit the same, but they are not authorized to receipt for money.

The American News Company, Nos. 39 and 41 Chambers street, New York, are agents for this JOURNAL. Newsdealers will send orders to them.

Correspondence.—Wishing to make this JOURNAL a gazette of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, correspondence is solicited for publication from all who make the study of those subjects a pleasure or a profession.

Books.—We will forward by express, at publisher's lowest rates, any book—scientific or otherwise—to any address in the United States or Canada. We would suggest to our patrons that to avoid the risk and expense consequent on sending us the money (we do not send books C.O.D.), that orders for books be sent us through the Purchasing Department of the American Express Company.

CONTENTS.

An Asterisk (*) denotes an illustrated article.

OFFICIAL NOTICES—
American Gas Light Association..... 433

EDITORIALS—
Briefly Told..... 434
Death of Mr. Samuel Prichitt—Matters Connected with the New York Meeting—The Western Contingent Getting Ready—The Gas Club of Chicago—Notes.
Basic Units of Economy in the Manufacture of Gas and Electric Lights, by Mr. R. B. Taber..... 434
Gas Supply in the Hands of Local Authorities, by Mr. J. Hepworth 435
Central Stations Operated by Water Power, by Mr. G. A. Redman. 437
Different Forms of Carbons Used in Arc Lighting, by Mr. W. C. Warner..... 439
*The Simpson Alkali Process..... 440
Analysis and Cost of Rose Fuel Gas..... 441
Special English Correspondence..... 441
Testing Coals—Value of Gas Stocks and Shares—Inclined Retorts—A Metallic Gas, etc.—Mr. G. Livesey and the Quality of London Gas.
Economics of Iron and Steel..... 442
Coal Raised from Deep Mines..... 443
ITEMS OF INTEREST FROM VARIOUS LOCALITIES..... 443
To Extend the Franchise—Public Lighting, Saratoga Springs, N. Y.—Cheaper Gas for Nashville, Tenn.—Free Gas for an Asylum—An Appeal Taken by the Walworth Lighting Company—Breaking Electric Lighting Lamps—Sued for Water Rates—Public Lighting, Cambridge, Mass.—Dr. Schilling Resigns—Death of Amos J. Bicknell—Positions in the India Petroleum Trade Reversed—The Crystal Palace District Gas Company—Public Lighting, Haverhill, Mass.—Hartford Gas Does not Need Inspection—Annual Meeting, Worcester, Mass.—Obituary Note, Hon. W. L. Scott—Personal—Tall Mast Lighting a Failure at San Francisco, Cal.—And Other Items.
The Market for Gas Securities..... 446

[OFFICIAL NOTICE.]

American Gas Light Association.

"SEC. 51. *No member who owes two years' dues shall be entitled to vote, or to participate in the deliberations of the Association, or to receive a copy of the proceedings.*"

This provision of the Constitution will be enforced at the coming meeting.

PHILADELPHIA, PA., Sept. 1, 1891.

Mr.....

The practice established a year or two since of collecting dues in advance of meeting has operated as expected, in facilitating the transaction of business at the meetings. It is especially necessary that this course should be followed this year.

Remittance may be made by check, post office order, registered letter, or by express. Address Drexel Building, Philadelphia.

The amount of yearly dues is shown below.

Attention to many matters, including the sending out of these notices, has been delayed by the long illness of the Secretary. By giving this your immediate attention you will assist in straightening out matters, and you will confer a favor upon

Yours truly,
ALEX. C. HUMPHREYS,
Acting Sec. and Treas.

Dues for year ending Sept. 30, 1892, $5.

[OFFICIAL NOTICE.]

Nineteenth Annual Meeting of the American Gas Light Association.

EXTRACT FROM THE CONSTITUTION.—"SEC. 12. *Application for Active Membership, or for Associate Membership, or for transfer from Associate to Active Membership, must be received by the Secretary at least ten days prior to the meeting at which the application is acted on.*"

SECRETARY'S OFFICE, Sept. 9th, 1891.

Dear Sir—This circular is sent to many members of the gas fraternity who are not on our roll of membership; it is done with the object of pressing upon their attention the question of applying for membership in the Association. In these days of sharp competition, no gas man can, in my opinion, afford to remain outside of the Association.

Particular attention is called to Sec. 12 of the Constitution, as shown above.

The application calls for the endorsement of two active members. This should be borne in mind in connection with the Constitutional requirement above quoted, namely: That the *completed* application must be in the hands of the Secretary 10 days in advance of the meeting. Parties applying for admission will of course be welcome at the coming New York meeting, which is set for October 21, 22 and 23.

All correspondence, in regard to application for membership, should be addressed to me at Drexel Building, Philadelphia.

Yours truly, ALEX. C. HUMPHREYS,
Acting Secretary.

Drexel Building, Philadelphia, Pa.

MR. SAMUEL PRICHITT, President of the Nashville (Tenn.) Gas Light Company, died at his home in that city on the morning of Monday, September 21st, after a protracted illness. He was a member of the Western Gas Association, and also of the American Gas Light Association, and was known and respected by the fraternity the country over. His fortitude during an illness that covered a period of not less than five years was simply amazing. In due time we will give to our readers an extended history of his life.

BRIEFLY TOLD.

MATTERS CONNECTED WITH THE NEW YORK MEETING.—Acting Secretary Humphreys is having a busy time of it arranging for the routine of the coming meeting of the American Association in this city, and affairs are now shaping up so that he will speedily be in position to formally announce the numbers on the literary portion of the programme, as also the generally expected concessions that the trunk railway lines are to make in the matter of fares, etc. Some difficulty, in fact, more than usual, appears to have been encountered in securing papers for the convention, but the Secretary and the Council, by dint of persuasion, have finally been completely successful in obtaining a good number of contributors, who will present live themes to the consideration of the meeting. The Committee of Arrangements have about completed their labors, and the gentlemen composing the committee are to be congratulated on the scheme of entertainment perfected by them. It is novel and inviting; but such termination to their devisings could but be looked for when one recalls to mind their names. All are well versed in the art of entertaining, and with such a field as New York to work in, they had ample opportunity to display their talents as amusement providers. We look forward to a rousing meeting in New York, and it behooves the members to make their arrangements early at home, so that their presence in New York in October will be assured.

THE WESTERN CONTINGENT GETTING READY.—Writing of the attendance at the meeting puts us in mind of the fact that the Western contingent promise to come to town in solid phalanx, that indefatigable worker, Fred. R. Persons, of Chicago, having very sensibly determined that, if possible, the trip East should be made in true regimental fashion rather than after the style of the awkward squad. Perhaps the following circular letter, that is being distributed amongst the Western gas men, will best explain just what is proposed in the direction indicated:

CHICAGO, Sept. 19, 1891.

Dear Sir:—Are you going to attend the American Gas Light Association meeting, in New York, October 21st to 23d? Can you arrange to go by way of Chicago, leaving Chicago, Sunday, October 18th at 3:10 P.M., spending part of the next day at Niagara Falls, and arriving in New York, Tuesday, the 20th?

The Michigan Central and N. Y. Central Railroads will furnish us a special Pullman car at no additional expense over the regular rates, and give us every convenience and attention. If you would prefer to leave on Monday and go direct, without stopping at Niagara, please state it in your reply. We will be governed by the majority. An early reply will assist the Committee in perfecting arrangements. Yours truly,

FRED. R. PERSONS.

Mr. Persons requests that all replies to this circular be addressed to him at No. 75 North Clinton street, Chicago.

THE GAS CLUB of CHICAGO.—Some weeks ago we spoke of the probable formation at Chicago of a Society of Gas Engineers, to be modeled somewhat on the lines of the Society of Gas Lighting, or the Guild of Gas Managers, and we can now say that the organization was perfected on Wednesday last, at a meeting held at the Grand Pacific Hotel, Chicago. The 25 who responded to the call included many gas men of prominence in the West and all were enthusiastic partisans of the proposed Society. The name adopted was that of The Gas Club of Chicago. Mr. E. G. Cowdery, of Milwaukee, was chosen Temporary President, and special committees to report a set of laws, to nominate officers, etc., were appointed with instructions to hand in their conclusions at the next meeting, which was named for an early date. The Club is bound to be a success.

NOTES.—President John P. Harbison, of the American Association, has been indisposed for some days, but his rugged physique and abundant pluck make a very poor combination for illness to prevail over.—And this leads us to say that Mr. W. W. Goodwin is mending so rapidly that his return to active business is but a question of a short time.—The Newark (N. J.) Gas Light Company is completing the laying of a 10-inch main from its works on to and through the chain of handsome towns that comprise the Orange districts.

[A paper read before the Society of Gas Lighting.]

Basic Units of Economy in the Manufacture of Gas and Electric Lights.

By MR. R. B. TABER.

My attention was attracted to the discussion of a basic unit of economy in gas manufacture which virtually formed the subject under another name of quite a discussion in the meeting of the Western Gas Association at Louisville. Under the *regime* of the Gas Commission in Massachusetts the yearly returns of each company are made up in a form prescribed by them, and the relative economy of different plants, their status before the Board, and the protection or control, perhaps their very immunity from attack, may depend upon the returns thus rendered, based on the relative unit of cost per 1,000 cu. ft. sold. To obtain this the itemized figures might be divided as follows:

1. Cost of manufacture, or the efficiency of the apparatus—say, coal, enrichers, water, labor, repairs at works.
2. Cost of distribution, or the efficiency of the street mains—say, wages of meter takers, repairs to meters, repairs to mains.
3. Cost of office, or the efficiency of the personnel and general staff.
4. Cost of capitalization, or the efficiency of the capital—say, taxes, legal expense, etc.

The further items of depreciation and interest are carried to separate accounts. This unit coincides also with the English system, and so general has the habit become that many of the new patent processes have taken advantage of the custom and cry up 15 cent wares, trusting that the cost of manufacture covering only a few of the items specified above may be confounded with the total cost delivered, as indeed it is likely to be by inexperienced investors. It would be better, then, that similar discussions to those at Louisville might be held to determine a basis upon which gas engineers may agree as to the relative cost of gas making; for it was evident in the discussion the Massachusetts standard was not in use in Rhode Island; and an engineer may be of good standing and show creditable reports in one State and be misunderstood or underrated in another. Or an investor may trust in certain reports to great disadvantage by simply relying on an "eminent" engineer's statement of the cost of gas as made by a certain process.

In my own case, where it is often necessary to make comparison of the efficiency of gas plants with that of electric plants, and *vice versa*, I have been compelled to adopt another system in which the cost of gas and electricity is expressed in decimal percentages of the total income, thus affording a less circuitous route to the result wanted; in other words, expressing the unit of sufficiency, not in number of feet, or more properly, candle feet, of gas sold, but in the income received for that amount of gas—conditions made necessary in selling electricity, since the number of arc lights or incandescent lights, or even the number of watts sold, has no special significance, and is extremely difficult to obtain. In electricity, therefore, the items arranged as before, viz.:

Cost of manufacture, including coal, water, oil, waste, labor, and repairs at station;

Cost of distribution, including wages, repairs of lines and meters;

Cost of management, including superintendent, office expenses, horse hire, etc.;

Cost of capitalization, including taxes, legal expenses, insurance, etc.;

are summed up relatively to the total income, and are expressed in percentages of the same.

For instance, in 49 electric stations whose reports are made monthly and cover a period of 15 months I found

6	Companies	report	the	rate	of	expense	to income to be 50 to 60 per cent.
13	"	"	"	"	"	"	60 to 70 "
20	"	"	"	"	"	"	70 to 80 "

Ten above this limit, or a total average of 69 per cent.

You will notice that neither in the Gas Commissioners' report nor in the above enumeration of expense is any allowance made for depreciation and interest, which are carried into the profit and loss accounts and do not figure in the relative efficiency of staff and apparatus. As a matter of fact there is probably some error arising from this source in the following averages deduced from the last published Commissioners' report, yet the figures given are approximate. Thus, in the towns whose annual consumption is over 25,000,000 cubic feet,

2	report	a	ratio	of	expense	to total gas and residual income of 50 per cent.	
12	"	"	"	"	"	"	60 to 70 "
5	"	"	"	"	"	"	70 to 75 "

And of the 73 companies of the State the average would be slightly higher.

Such figures are less scandalous and alarming surely than the old piratical stories of gas costing 15 cents, 9 cents, or even 3 cents, so often heard, and allow a fair business comparison with other manufacturing industries breaking through the long continued isolation of the gas business, which has oftener proved a curse than a blessing.

I have said that the matters of depreciation and interest are referred to profit and loss accounts rather than to expense accounts, and scarcely affect the subject of the unit of efficiency. When carried to expense, as depreciation sometimes is, it is a variable quantity, based, of course, on the amount of the repair account each year.

In few cases that I know is a direct charge made in the gas accounts; fewer still in electrical returns, where seemingly more necessary. I say seemingly, because it is the general impression that the repair and depreciation accounts in electric stations should be very large, and I was somewhat surprised to find, in the 49 stations quoted above, that the actual cost of repairs averaged in the total cost of the stations—

For repairs and renewals of	lamps	2.98	per cent.
" "	lines	1.37	"
" "	dynamos	1.23	"
" "	station	1.34	"
" "	engines	.95	"
" "	boilers	.96	"
Or		8.83	per cent.

It may be presumed, then, that a station well kept up and well repaired will depreciate only by the loss of renewals as the business increases; nor are the new patents superseding and making valueless the earlier form of apparatus. The first Brush dynamo is still running, and high speed Armington & Sims engines at the end of five years are practically as valuable in a station as when first run; and it seems to me a proper repair account will quell that picture of an exhausted treasury depleted by the phantom of an immense friction silently wearing away dynamos, lines, poles, etc.

It is, of course, certain that in a poorly managed station, as in a poorly managed gas works, a wonderful amount of damage can be done in a wondrously short time. An armature can be ruined, or broken flywheels send tons of iron skyward as readily as gasholder tanks or purifier roofs can fall; but such things are not common. I quote from the experience of the Electric Mutual Insurance Company, of Boston, which covered about $3,000,000 of electric property during the year 1890, that their loss was but $133.05. The report of the Committee of this Society, placing "daily expense, taking interest, insurance and depreciation, at 16 per cent.," is undoubtedly excessive in the light of to day. For this last item of interest is so strictly outside the ken of the gas engineer that it might be said of it that it is a matter over which, like the watery skies, he has absolutely no control. The Commission's report, however, has some curious figures, if placed in juxtaposition, and will prevent any hasty criticism that our methods are better than our father's in the manipulation of stock companies, and show also how in good hands good investments can be made a success. For if we compare capital on which interest is based and income in the more important towns of the State, the ratio of gas and electric income in each city to the total invested is surprisingly similar. Boston, Lynn, Worcester, Salem, are good instances of this and serve to show that the interest ratio would not materially affect the unit of efficiency which I have adopted for comparison for working of gas and electric light plants.

Gas Supply in the Hands of Local Authorities.

[A paper read by Mr. J. Hepworth before the English Association of Local Boards.]

The subject of gas supply is one of considerable importance to local authorities; and while it has not been neglected by them in the past, it should continue to receive their careful attention in the future.

Although gas for lighting and other purposes has only been introduced within the present century, it has practically become one of the necessaries of life; and notwithstanding the competition of other illuminants, there is no evidence as yet that it is likely to be superseded—its use, both for lighting and heating purposes, being largely extended every year.

There are at the present time some 1,600 gas works in the United Kingdom; and from the return relating to all the authorized gas undertakings, it appears that 578 out of the total number of works have been sanctioned by Parliament. Of the authorized undertakings, 405, or about 70 per cent., belong to companies; and the remaining 173, or nearly 30 per cent., belong to local authorities. The capital employed in the gas works of the United Kingdom has recently been estimated at £100,000,000; but the total capital employed in the authorized gas undertakings only in 1890 was as follows:

Authorized Gas Undertakings.	Total Number.	Capital Employed.	Per-centage.
Companies	405	£38,207,748	63.81
Local authorities	173	£21,669,789	36.19

The local authorities, with the exception of a few instances, did not undertake the responsibility of gas supply when gas was first introduced. It was only after it had been proved to be a great public convenience, and its supply had been established as a commercial success, that public bodies, as a rule, became convinced of the importance of undertaking the supply. Some of the arguments adduced for local authorities assuming this responsibility are: That gas is a public necessity; that its supply has become a monopoly; that the supply of a commodity necessitating frequent interference with the public thoroughfares should be in the hands of the public authority having charge of those thoroughfares, and not of private individuals; that the security of the public rates enables local authorities to raise money at a cheaper rate than gas companies, and therefore to manufacture gas at a less cost than companies can; and that any benefits derived from the supply of gas should go, not to private individuals, but to the public—either in the promotion of public improvements, the reduction of the public rates, or reductions in the price of gas.

There is no necessity to discuss these arguments now. They have been advanced with more or less force by local authorities; they have been sanctioned by the Legislature; and the following General Acts of Parliament for establishing or acquiring gas undertakings have been passed as the result: The Gas and Water Works Facilities Act, 1870, and its Amendment Act of 1873; the Public Health Act, 1875; and the Burghs Gas Supply (Scotland) Act, 1876. The public Health Act, 1875, enables urban sanitary authorities to become suppliers of gas by the purchase of gas undertakings already in existence, and to supply gas within their district by themselves erecting gas works under the powers of a Provisional Order to be granted by the Local Government Board, or by obtaining a Special Act to effect the same purpose. The Burghs Gas Supply (Scotland) Act, 1876, also confers similar powers upon local authorities in Scotland.

The powers conferred by these several Acts have been extensively used, albeit not so extensively as seemed probable at one time; and some of the largest provincial gas works have now been acquired by local authorities, and are supplying gas to areas much larger than the district of the authorities in question, and with manifest advantage to all concerned.

It is unnecessary to discuss the relative advantage of a Special Act or a Provisional Order enabling a local authority to acquire a gas undertaking; these can only be determined on a full consideration of the circumstances in each case. But wherever a local authority finds it desirable to supply gas outside its own district, it is then necessary to obtain a Special Act; and the fact may be noted that there are comparatively few authorities supplying gas who have not found it either desirable or necessary to have a Special Act for the purpose.

The Legislature does not give power to local authorities to compete with any authorized gas undertaking; but there are instances where local authorities have succeeded in obtaining powers to establish gas works in districts in which a company has already been legally authorized. In all cases, however, Parliament has properly refused to assist in confiscating the property of the private company, and has limited the powers of the local authority to a supply of gas to the public lamps and other public purposes of such local authorities. It need scarcely be said that such a limitation precludes the possibility of any advantage whatever to the local authority; and the loss of the public lighting has not in all cases proved to be a disadvantage to a gas company. In cases where gas works already exist, the only way in which the local authority can succeed in effecting any beneficial result is by first buying up the established company; and wherever a local authority has succeeded in obtaining the powers of supply, it has been with the condition attached that the rights of the existing company should be purchased by the local authority.

The capital employed in the gas undertakings of local authorities has already been given at £21,669,789. The terms allowed for the redemption of this capital vary from 30 to 100 years. But the usual maximum is 80 years; and the tendency of late has been to reduce that limit. In the author's judgment 50 years ought to be adopted as a minimum term for the repayment of capital employed in gas works. With a less limit than this, there is an inducement either to erect works of an

imperfect character, or to allow the works to become dilapidated. The result in either case is that the cost of maintenance becomes ultimately excessive; and the excessive cost of gas under such conditions follows as a natural sequence. On the other hand, if the works are properly constructed in the first instance, and the cost of maintenance is kept reasonably low, the works may prove a valuable asset even at the end of 50 years. Moreover, when gas companies authorized by Parliament are permitted to maintain their capital in perpetuity without any reduction, the conditions imposed upon local authorities, of repayment within a shorter period than 50 years, become not only onerous, but retard the benefits which ought to accrue to local authorities in the earlier periods of their gas undertakings.

The rate of interest at which local authorities have been able to raise the capital employed in their gas works varies from 3 to 5 per cent.; but it is not now necessary to give much more than 3 per cent. The importance of this fact may be estimated when it is remembered that the dividend paid on capital employed in the authorized gas works owned by companies in 1890 averaged £8 11s. per cent. There can be no doubt as to the advantages possessed by local authorities over gas companies in respect to the terms on which they are able to raise capital; and assuming that a gas undertaking has been acquired at a reasonable price, and that other things are equal, the possession of the undertaking ought to prove a substantial public benefit.

The terms upon which the transfer of a gas undertaking to a local authority takes place are usually arrived at by arbitration; and in the case of a statutory company, the amount in recent years has varied from 25 to 28 years purchase of the maintainable profits—the amount differing according to the circumstances of the case. When the undertaking is not an authorized one, the value is proportionately less, and has in several instances been taken at about 20 years' purchase of the maintainable profits—circumstances again governing the amount awarded.

The benefits which have accrued to the local authorities from the possession of gas undertakings have been greater than is generally recognized; and if, in exceptional cases, gas works in the hands of local authorities have not proved so profitable as might have been anticipated, this has usually arisen from mismanagement on the part of the authorities themselves. The benefits arising from the profits derived from the gas supply and from reductions in the price of gas may be especially noted.

Profits from the Gas Supply.—There are differences of opinion as to the advisability of local authorities supplying gas at a profit; and the Burghs Gas Supply (Scotland) Act, 1876, expressly provides that the gas shall be supplied at such a price "as will, as nearly as can be estimated, raise sufficient income to discharge all the costs and expenses of and incident to the manufacture and distribution of the gas made, together with the interest on all money borrowed in respect of the works, and to provide the sinking fund required by this Act, and to provide for a depreciation and renewal fund sufficient to maintain the works in perpetuity, and for all charges incident to the occupation of such works; and the moneys received in respect of and incident to the manufacture and distribution of gas shall be applied to such purposes only, and any balance at the termination of every year shall be carried to the debit or credit of the succeeding year." That is to say, no profit is to be made. This provision of the Burghs Gas Supply (Scotland) Act, 1876, has not been incorporated in any Act relating to England and Wales; and the practice of the local authorities accordingly varies.

The total amount of net profit actually realized by local authorities on their gas undertakings in 1890, after payment of interest on loans, annuities, repayment of loans, and amount placed to redemption and sinking fund, was £486,483, which is equal to 2¼ per cent. upon the gross amount of money borrowed, not deducting the amount repaid. As 2¼ per cent. does not represent the whole of the difference between the rate of interest or profits paid upon the capital employed in the gas works of local authorities and of gas companies, it may be safely assumed that the consumers have not had to pay a higher price to local authorities for their gas than they would have been called upon to pay to gas companies; but, when examined, the prices charged by local authorities for gas prove that this is so.

The net profit referred to, amounting to £486,483, has been applied in various ways, viz., to a reduction of the capital account; to extension of works; to meet deficiencies in the water accounts (as was lately proposed also in the Manchester Corporation); to the free lighting of the public lamps; to defray the cost of the electric light, the cost of municipal buildings, markets, free libraries, and public improvements; and to the city or borough fund, and also to the district fund, in aid of rates. There may be some doubt as to the wisdom of such application of gas profits; but the fact remains that a sum of nearly half a million pounds sterling was thus applied last year. The effect of such an application of profits is to maintain a higher price for gas than is absolutely necessary. If such a policy can be justified at all, it may, perhaps, be justified by the theory that a local authority has a right to make as much profit as a private company would be allowed to make in similar circumstances.

The author's view is that all local authorities should follow the practice compulsory upon the local authorities in Scotland, and sell gas at cost price, certainly within their own district, and especially when "cost price" does, and in every case must, include the amount necessary to extinguish the capital of the undertaking within the prescribed number of years. The price at which a local authority should supply gas to an outside district may, as in the case of companies, very properly be in excess of that charged within its own district; and the amount of the excess is usually regulated by the distance which gas is conveyed, the consumption per mile of main, and other local circumstances. If the gas supplying authority derive a reasonable margin of profit in such a case, it should not lead, as it sometimes does, to discontent on the part of those receiving the supply. A legitimate profit is not only reasonable, but in the case of a local authority will probably be less than would have been paid if a company had supplied the gas; and if the profits are being contributed by one district to an adjoining district, the hardship, if it be one, is no greater than would exist if the profits had been contributed to a gas company, whose shareholders might by chance reside in every district in the United Kingdom. As I have said elsewhere, however, it must be left with the local authorities themselves to determine their own policy in this matter.

Price of Gas.—The lowest price charged for gas in the United Kingdom in 1890 was 1s. 9d. per 1,000 cubic feet; and the gas was supplied by a company. The lowest price charged by any local authority was 1s. 10d. per 1,000 cubic feet. If it be true, as is sometimes alleged, that the price charged for gas supplied by the local authorities is higher than it need be, it cannot be said that it is anywhere excessive when compared with the prices charged by companies under similar conditions; and certainly the price of gas has been steadily reduced by nearly all local authorities when they succeeded to the gas undertaking of their respective districts.

One of the greatest hindrances to the reduction in the price of gas in the case of local authorities arises from a tendency to entrust the management of their works too much either to members of such authorities or to incompetent managers; and this tendency exists not only in small gas works, but in several of the largest in the country, and is absolutely without excuse. There are notable instances of local authorities, selling gas at admittedly low prices, who, if their works were under good management, could largely reduce the cost of production, and effect the annual saving of large sums of money now being wasted; but this economy might involve new principles of management, the introduction of better qualified officers, and possibly an increase in salaries. In the interests of economy and efficiency, however, and also with the view of improving the quality as well as reducing the cost of gas, local authorities would do well to consider the possibility of improving their methods of management.

From the fact that there have been only 25 gas undertakings acquired by local authorities during the last eight years, it may be inferred that the introduction of the electric light has had, and still has some influence in deterring these authorities from assuming such risks as are attached to the supply of gas. It has already been stated, however, that, notwithstanding the competition of all other lighting agents, the increase in the consumption of gas continues from year to year. The value of gas undertakings, therefore, has in no degree been depreciated in consequence of that competition—indeed, their value has been, and still is steadily increasing; and it is a striking fact that the consumption of gas for other purposes than lighting (the "day" consumption as it is termed) is not only extending, but in some towns now amounts to 50 per cent. of the total consumption.

The obvious conclusion is that those who are in possession of authorized gas undertakings have no reason to fear the future of their industry; and, speaking from a 25 years experience as the engineer of gas works belonging to local authorities, the author is of opinion that authorities either in possession of, or seeking to possess such undertakings, will find that gas works in their hands will continue to be one of the most valuable of their undertakings.

THE Company furnishing natural gas in the cities of Oil City, Titusville, Meadville and Franklin has notified the residents that on and after Oct. 1st all gas supplied will be on the basis of the meter system, the gross rate to be 20 cents per 1,000 cubic feet.

[A Paper read before the National Electric Light Association, by Mr. Geo. A. Redman, Rochester, N. Y.]

Central Stations Operated by Water Power.

The purpose of my paper is more to give a description of what is being done with water power for electrical purposes in the city of Rochester by the three different electric light companies doing business in that city, and some of my own experience with water power, than to take up your valuable time with the technical description of turbines, which can be gleaned from any of the numerous catalogues of turbine manufacturers, which contain full descriptions of turbines and their construction.

The adaptation of water power for electrical purposes has grown very rapidly within the past few years. There are several causes operating to enhance the value of water power, none more so than that of electricity.

Streams that have had no pecuniary value heretofore are now being utilized for the purpose of running electrical machinery, yet at the same time the supply of water is diminishing, caused by the destruction of forests, and water right owners in various parts of the country are devising means of storing water during the rainy seasons to furnish a supply during the dry season; also storing it in the daytime for night use. One large water right owner in western New York, during the months of July and August, places flash boards 2½ ft. high on top of his dam, at an expense of $100, and stores up for night use the water which is not necessary for him to use in the daytime, thereby saving in the two months a coal bill of $2,100.

The Johnstown, N. Y., Electric Light Company have improved their water power at the Cuyadota Falls by erecting a dam 34 ft. high on top of the falls, giving them a total head of 75 ft. and nearly doubling the amount of power.

A survey of the upper Genesee river, between Mount Morris, N. Y., and the celebrated Portage Falls, has been made during the past year for the purpose of establishing a reservoir that will furnish the city of Rochester 30,000-horse power more daily during the entire year than they have at present.

The earliest forms of water wheels were the paddle and flatter wheels that only utilized the impulsive action of the water; these were followed by simpler wheels of the reaction type and others.

We now have the improved forms of the Leffel, Victor, Lesner, Success, and many others. There is a demand for the best and most economical turbine that can be manufactured.

Turbines should be built to secure the delivery of the water upon the turbine without checking the velocity of the water more than one-third, and permit the free discharge of same after passing through the turbine, and to work with as good efficiency under part gate as under full gate, and to be made of the best phospher bronze, to stand the wear and tear under high heads.

It is essential in locating central stations to be run by water power, to locate them where there is no great danger of a flood, or so protected by a breakwater as to make it perfectly safe, and also to avoid trouble with backwater upon the turbines.

Where a station is situated on the bank of a river it is best to take the water from the river by means of a raceway, with the headgates parallel with the flow of the water, and at times of a freshet or running of anchor ice, it will more than pay any expense incurred by so doing.

The raceway should be of a sufficient depth and width to permit the water to flow not more than 90 ft. per minute, and a waste gate should be placed in the side or end of the race to use in case of emergency; and when cleaning out the raceway a rack should be built across the race to prevent driftwood and other rubbish from passing into the turbines.

For that purpose I would recommend a rack built of iron slats 2 in. wide, one-eighth of an inch thick, and placed five-eighths of an inch apart on seven-eighth inch iron rods, at an angle of 45°. Particular attention should be taken to keep the rack clean by raking. A trough or platform should be placed over and immediately back of the rack to rake the rubbish and anchor ice into, and so arranged that a current of water from the race will pass through the trough and carry off all of the rubbish, etc. For any station that is using 100-horse power or over, it will be a great saving in labor to them and pay well for the extra expense. For winter service a boom should be placed in front of the headgates, and the current will carry off a large portion of the anchor ice and other floating objects.

The headgates should be built to work with a rack and pinion; also a roller should be placed back of each gate stem to facilitate the handling of the gate.

The gates should have a protection built over them, to protect the gearing from the storm. In a cold climate, where the gates are apt to be frozen in, salt is essential in freeing them from ice; all headgates and timbers should be of the best quality of oak, and should be well bolted, and not less than two gates to one raceway. The tail race should have not less than 2 to 3 ft. of dead water when the wheels are not in motion.

Where the tail race runs under the station, cement floors should be laid to prevent moisture in the station; a floor of that material will soon pay for itself.

Vertical turbines should be placed so that the steps are covered with water at all times. In adapting turbines to very high heads, or to conform to location, it becomes necessary to set the turbines above tail water and conduct the water away from the turbines, through a draft tube; the same depth of pit and area of discharge is required where a draft tube is used, as would be when the turbines are set at the bottom of the fall; the mouth of the draft tube should always be submerged about 6 inches in standing tail water. It is claimed that draft tubes can be used 30 ft. in length. I do not think a draft tube more than 18 ft. in length should be used on account of the difficulty in keeping the tube airtight, for if the tube leaks the vacuum is imperfect and there will be a great loss of power, and where steps are used they will be apt to be burned out.

When possible, I would advise horizontal turbines to be used, as they are easier taken care of, and many of them are used without any steps. The burning out of steps is an expense and annoyance. One of the greatest advantages in the horizontal turbine is that the dynamo can be belted direct to the turbine shafting, and is in some cases coupled direct to turbine, making a good percentage in economy in power and advoiding the use of gearing, and I deem it advisable to put in a number of small turbines, in one large one; in case of a break down, they are more easily repaired and cause less delay to customers.

In the old station of the Brush Electric Light Company, of Rochester, the vertical turbines caused considerable annoyance in the burning out of steps and stripping of the gears; so much so, that it became necessary to support the vertical shafting with water cushions. For wooden steps we have had the best success with lignum vitæ.

In my opinion, governors for the turbines are necessary and will govern any slight variation of load under high head, but where one-third or over of the load is thrown off or on suddenly, it is necessary to handle the gate by hand, as under the above circumstances the turbine is apt to slack down or run far above the normal speed, as the case may be; in the latter case causing the burning out of lamps and armatures. The governors should be placed as near the turbines as possible to save lost motion in the gate shafting and avoid the use of gearing as much as possible.

We have two governors in use in our office building under a low head of 16 feet, and they govern the turbines under all circumstances in quite a satisfactory manner.

The decided advantage of a water power station over one run by steam power, is not only one of economy in the saving of the expense of coal, but the station and apparatus can be kept cleaner and cooler, thereby saving considerable in expense of repairs, and it is also far more pleasant for the employees.

The Brush Electric Light Company, of Rochester, purchased the entire lower falls of the Genesee River (which is about two miles from the business center of the city) some nine years ago—at that time it was looked upon by many as a piece of folly, to think of running dynamos there, on account of the distance from the business center of the city and the dampness around the Falls. Notwithstanding the adverse opinions, they erected two buildings on the west side of the river above and near the brink of the Falls, and put in two 30½ inch Leffel, two 20 inch Victors and one 40 inch Leffel turbine, the first four mentioned turbines, under 94 feet head, and the latter under 28 feet head, with a total of 2,500 horse power. After running this power for five years they built a new station and leased their old power to different parties for pulp and flour mill purposes.

The new station is a three story stone building, 45 feet wide and 90 feet long, with a two story brick addition 42 feet wide and 80 feet long, and located at the foot of the Falls on the east side of the river. The turbine capacity consists of 15 double 15 inch horizontal Lesner turbines under 90 foot head, with 14 foot draft tubes, a total of 3,360 horse power, using 6.95 cubic feet of water per minute per horse power; have had but one turbine damaged to any extent in four years. The turbine casings are placed on iron girders with the ends of the girders resting on solid rock.

The amount of floor space occupied by all of the turbines is 4 feet by 38 feet; the weight of each turbine is 196 lbs., less than one pound to a horse power; each turbine is placed in a separate division of the casings

and the shaftings extend through the shafting room, upon iron bridge-trees, with seven feet and six inches between journals, and the dynamos are belted direct to the turbine shafting ; the shafting runs at 800 revolutions per minute, with 25 inch pulleys on the turbine shafting and 24 inch on the dynamos ; we use untried beef tallow for lubricating and are well satisfied with its results. The turbine gate shafts and governors are placed in the dynamo room at an average distance of 14 feet from the turbines, where they are easily handled by the attendants. A tell-tale is placed in the shafting room, connected to a float in the race above the Falls, which shows the height of water in the race at all times.

The water is taken into the raceway, about 80 feet above the Falls ; the race is 32 feet wide, and five feet six inches deep, and cut through the solid rock ; there are four headgates with a house built over them ; a wooden diagonal rack is placed in the race near the spillway to assist in freeing the race from anchor ice ; the spillway is six inches deep and 32 feet long. The waste gates are placed next to the spillway and are three feet six inches wide ; there are two of them. In front of and near the top of the penstocks an iron rack is built according to dimensions given; also a rubbish trough.

There are three iron penstocks, six feet in diameter and 80 feet high ; built of three-eighth inch boiler iron, with a gate to each penstock. There are five elbows to each penstock leading to as many turbines, with an iron slide gate to each elbow ; in addition, each turbine has a register gate, thereby permitting the repairing of any one turbine without interfering with the running of the others. A turbine can be taken out and another put in its place in 25 minutes. Cement floors are laid in the shafting and turbine rooms.

There are three tail races, extending under the entire length of the main building ; each race is nine feet wide and six feet and six inches deep.

As a reserve power, when making repairs and cleaning the raceway, we have a 600 horse power Cooper Corliss engine ; in the past year it has been necessary to use it but a few days.

For fire protection, two-inch iron pipes are run from the penstocks through both buildings with four lines of hose attached at all times ; the hose is tested once a week ; in addition to the hose, a dozen fire pails filled with water and placed in different parts of the station are kept in readiness, and are not permitted to be used for any other purpose.

A record is kept of the time of starting and stopping of each turbine, also the speed and load on same, and any variation in height of water, and all repairs that are made. In addition to the above records, the day and night wheelmen report the condition of the power at the time they are relieved.

There are nine men employed at the station, five of them in the dynamo department and four in the water power department. We have in service 30 dynamos ; three of them are run without any stoppage and the balance of them on an average of 13 hours per diem. A record book is kept in the dynamo room, in which entries are made of the time of starting, stopping, speed and load of each dynamo, also all repairs of every description, all accidents to either machinery or circuits, nature, time and cause of same. All the circuits are tested five times daily, and the tests and time of same entered in record book.

By the means of water power the company is enabled to furnish cheap and satisfactory light and power at the following rates, viz.: City arc lights, all night and every night, 27 cents per night ; commercial arc lights, all night and every night, 40 cents per night ; commercial arc lights, evening, 25 cents per night ; commercial arc lights, evening and all day, 40 cents ; ¼ horse power motor, $18 per annum ; ½ horse power power motor, $48 per annum ; 1 horse power motor current, $72 per annum ; 2, 4 and 6 horse power motor current, $50 per annum per horse power ; 8, 10 and 15 horse power motor current, $40 per annum, per horse power ; ¼ horse power fan motors, $15 per season, from June 1st to October 1st ; 16 candle power incandescent lamps, $5 to $12 per annum ; 25 candle power Bernstein lamps, $12 per annum ; 50 candle power Bernstein lamps, $24 per annum ; 100 candle power Bernstein lamps, $48 per annum.

The rates I have mentioned are for arc circuits ; our rates for current on 500 volts constant potential circuits are as follows, viz.: 1 horse power, $48 per annum ; 2 horse power, $96 per annum ; 5 horse power, $180 per annum ; 8 horse power, $240 per annum ; 10 horse power, $300 per annum ; 15 horse power, $450 per annum ; 20 horse power, $600 per annum.

We operate a total of 832 motors, of which 196 are fan motors, 1,396 arc, 135 Bernstein and 200 Swan incandescent lamps. One motor circuit contains 26 miles of outside wire and 394½ horse power "C. & C.," one 2 horse power and one 4 horse power Brush motors, and is run with a No. 8 Brush arc dynamo. We have one 40 K. W. 500 volt "C. & C." generator in service, on an eight mile circuit, with 48 horse power in motors in use ; the ammeter averages 29 amperes. We experience no difficulty in running same with our power.

The rebate for poor service during the year ending December 31, 1890, was one one-hundredth of one per cent. of the gross receipts, and the uncollected accounts for the same period was one-tenth of one per cent. of the gross receipts.

The Edison Electric Light Company have recently erected a three-story stone station at the foot of the upper Genesee Falls, on the west side of the river, and have at present two double discharge Leffel mining wheels under about 90 feet head, giving six hundred horse power, and are placing two more of 400 horse power each. In addition, they have a fine steam station in the center of the business district. Incandescent 16 candle power lamps are furnished at one cent per lamp hour ; arc lamps for city use, 28½ cents per night ; municipal incandescents at six cents per night. The latter they are partially replacing with arc lamps. They have in circuit 105 arc, 805 municipal and about 13,500 16 candle power incandescent lamps.

The Rochester Electric Light Company's plant is situated at the upper Genesee Falls, on the east side of the Genesee River, near the business center of the city. The station is three stories in height from the top of the Falls, with the wheel pit underneath, blasted out of solid rock 95 feet in depth. They have five Leffel horizontal turbines ; four are 23 inches, and the other 80½ inches in diameter, with a total of 1,500 horse power, undear a head of 86 feet and eight inches.

The penstock is a steel pipe seven feet in diameter ; the power is transmitted to five shafts 80 feet above by belts 173 feet in length, running at a speed of 7,200 feet per minute.

The dynamo room is directly over the shafting, from which all of the dynamos are belted through the floor. The dynamos are the United States system.

They have in service 325 city arc and 140 commercial arc lamps ; also 1,500 incandescent lamps and two 10 horse power motors. They have just placed one 85 horse power generator and one 1,500 light Westinghouse alternating dynamo. As a reserve power, they are putting in a 400 horse power engine. The city lights are being furnished at 27 cents per light.

In addition to those I have mentioned, there are five incandescent plants and one arc isolated plant run by water power in Rochester, some 500 incandescent and 25 arc lamps, making a grand total of 1,991 arc and 16,640 incandescent. The population of Rochester is 135,000, making a very high average per capita.

Electric Lighting in London.

Engineering, in the course of an article on the advance of electric lighting in London, remarks that after being for many years behind every other important city in Europe and in America in the matter of electric lighting, London has suddenly distanced all its Continental rivals, and is within a measurable space of surpassing New York. This change has taken place in a very few years, and originated in the Electric Lighting Amendment Act of 1888. Previously to that scarcely anything had been done in the way of public lighting, if we except the operations of the Grosvenor Gallery Company and the Cadogan Electric Lighting Company of Chelsea. But on the passage of the new law there was a rush for provisional orders, and now there are already 240,000 lamps of eight candle power under supply, as noticed by us in our issue of August 21. These figures, as we then stated, were taken from a report in the *Times*, which went at considerable length into the causes, first, of the slow progress of electric lighting in London in the years 1882–1888, and, second, of the late rapid burst. In finding a reason for the long delay, the *Times* did not attribute it entirely to the effect of Mr. Chamberlain's Act, which provided that a municipality might buy out a supply company at the end of twenty-one years, without any compensation for compulsory purchase or goodwill. On the contrary, it held that electric engineers were not in a position at the date of the Act to carry out any ambitious schemes, and that if it had not been passed the progress must have been much slower than of late. There was a great eagerness at the time to invest money in electric companies, and if an artificial barrier had not been raised, when "the finance of the question had outstripped its science," it would have been found how incomplete the science was. This view of the subject brought a letter from Mr. R. E. B. Crompton, who in contradiction of it repeated his well known assertion that the station which he designed for the Edison Swan Company in 1883, and which was partly installed in Pimlico, was quite capable of effecting the lighting of Victoria and the

adjacent streets, and of earning fair dividends. Mr. Crompton admitted that immense strides had been made in the interval in the use of alternate currents, and that continuous current dynamos had been improved, but he insisted that in 1883 there was ample knowledge to proceed upon.

The two views thus put in opposition are those of the shareholder and the engineer. Of course when the latter asserts that his plant would have earned satisfactory dividends he goes beyond his province; as yet we have very little knowledge of the capabilities of electric supply companies to make profits. The shareholder has no enthusiasm for science; on the contrary, he has a profound dread of making experiments. What he delights in is a simple manufacturing process with a monopoly of sale. He knows that under the best of circumstances profits are not excessive, and that it needs very few adverse circumstances to eat them up altogether. Such a man naturally thinks that if he had put his money into an electric supply company in 1883 he would have seen very little return for it in the years that have since elapsed. He sees that dynamos have increased in size several times; he hears that their efficiency has much improved, and he knows that English engineers have now the advantage of much Continental and American experience. He is aware that, as yet, the bulk of the public hold back from the new illuminant, and that very little profit has been made. No wonder he thinks that eight years ago engineers could not carry out electric lighting work successfully, that is, in the sense of making it pay. Probably he is right. We quite accept Mr. Crompton's statement that his Victoria Station was capable of supplying 20,000 lights, but we think that he does not do full justice to all the scientific advances he has himself made in the mean time. Nothing is more difficult than to resume a former attitude of mind. Matters which appear perfectly commonplace to-day were eight years ago full of mystery to us. Hundreds of most capable men, both in the old world and the new, have been most earnestly at work on the subject of electric generation and distribution for these years, and yet we are assured that they have learned nothing of such importance as to make the difference between earning a dividend and making a loss, in a continuous current system.

In a manufacturing business—and an electric supply company is a purely manufacturing concern of the simplest possible kind—success depends chiefly on having no unproductive capital, and in keeping down working expenses. Now it is quite certain that for a given output both these items would have been greater in 1883 than at present. Dynamos were not only much more expensive then than now, but they were smaller, involving, a larger outlay for buildings and for foundations. The 3-wire system of distribution—an immense source of economy—was not brought out, and engineers had no information in the form of load diagrams to aid them in designing their plant. As to working expenses, they are still too high. Considering the absolute simplicity of the process carried on, the staff of an electric station is very large and expensive. But we should be sorry to think that very much has not been done since 1883 to simplify the management. We fear the shareholders in Mr. Crompton's station, had the plan been carried out, would have found their property more satisfactory from a scientific than from a financial point of view.

The writer in the *Times* did not quite accept Mr. Crompton's contradiction of his opinion, and last Friday a long letter was published from him, in which he returned to the attack. This is chiefly valuable in confirming the opinion that we formed from his previous communication that his views had a commercial rather than a technical basis. He makes the peculiar mistake of supposing that the percentage of loss of conversion of mechanical into electrical energy increases with the number of machines employed. He says: "As in the conversion of mechanical into electrical energy there must be of necessity a certain percentage of loss (5 per cent. or 30 per cent.—it is for the argument immaterial which) in every dynamo employed, it is obvious that the fewer the dynamos (consistent with the utilization of their full capacity and with the general efficiency of the whole plant) the less will be the totality of loss, and the more cheaply can electrical energy be generated and supplied." On the face of it this looks as if the writer meant that with machines of 90 per cent. efficiency there would be a loss of 10 per cent. in using one, 20 per cent. in using two, 30 per cent. for three, and so on. Probably, however, what he intended to convey was that large engines and dynamos are more economical than small ones. There is abroad quite an exaggerated opinion as to the relative economy of large and small engines and dynamos. It is quite true that very small machines have never a high efficiency, but a point is soon reached beyond which improvement is nearly imperceptible. It is possible to make an engine indicating 200-horse power as efficient as one many times its size, while a 500-horse power engine probably gives a better return for the money it costs to buy and work than any other size. Of course, in the happy future, of which the electric engineer dreams, when everybody will use his light, 500-horse power will be far too small a unit to employ in central stations. The size of the engine must be chosen in relation to the total amount of work to be done. Two engines will always be more trouble to manage than one, although they may not require more coal.

In denying that the pause in electric lighting arose from lack of knowledge, Mr. Crompton expressly excluded all reference to alternate current systems. These had no existence in 1882. Now they are in the front, and are exciting the deepest interest. Every one is watching the Lauffen-Frankfort experiments of the transmission of power for 110 miles, and if it prove successful the alternate current machine will take a yet more important position. This has not much to do with the electric lighting of London at present, but it is full of possibilities for the future. It is quite certain that the plan of small stations placed comparatively near together is not the one that will be perpetuated; indeed, it is doubtful if any of the existing methods of lighting will survive the term of 42 years that the monopolies of the companies run for.

Different Forms of Carbons Used in Arc Lighting.

[A paper read by Mr. W. C. Warner, before the National Electric Light Association.]

In the period just preceding the introduction of the arc electric lighting commercially, experimenters and inventors had brought forward numerous plans, ideas and theories regarding the size, form and manner of using carbons, and in view of the fact that no reasonably cheap method of generating the electric current then existed, a surprising amount of attention was given to the subject, and the developments of the art shown by many publications, from no small part of our history of arc lighting.

It is not my purpose to dwell at length upon the history of carbons generally, but rather to touch lightly on some of the more notable forms known, at the time of which I am speaking, and then to pass on to a consideration of the utility and practical results obtained with the different forms of carbons in use at the present time, paying special attention to the matter of form and size as affecting the results.

The form of a cylinder or pencil it is noteworthy was that used by Sir Humphrey Davy, in his earliest experiments, and he even devised special holders or claims to retain the carbon pencils in alignment and and facilitate their adjustment with a view of maintaining a constant steady light.

Archereau subsequently adopted the pencil form of carbon and used it in his lamp now so justly considered as the first practical arc lamp; it does not appear, however, that he turned his attention particularly to to the matter of form.

Wright and others stand on record as experimenters with carbon discs, brought edge to edge, and made to rotate as they were consumed, and the combination of a disc placed on edge above a vertical pencil of carbon was also tried at this early date.

Wallace and Farmer made use of broad, flat plates of carbon, placed in a vertical plane, one above the other, the arc forming between the edges as they were drawn apart, and shifting back and forth from one end of the plates to the other. Another inventor, at about this same date, placed flat plates of carbon side by side with the arc forming at the upper edges of the plates, and an intervening insulation of some refractory material, the the arc forming at the upper edges of the plates and gradually consuming them.

Jablochkoff, in 1876, introduced his well known electric candle, a form of arc lamp, in which cylindrical carbons are employed, placed in a vertical position, and held separated by a thin filling of refractory insulating material.

Now, when we look back at the work of these early inventors, and consider what special object they had in mind in making their experiments, it is at once apparent that it was continuity of action, and it stands on record that they met with fair success so far as the feature is concerned, some of the lamps being capable of twenty hours burning without attention.

In 1874 Mathias Day produced an arc lamp in which two cylindrical pencils were placed in the upper holders and two in the lower holders; the upper ones occupying a plane with the lower and directly over them. Here the avowed object of the invention was to secure long continued operation of the light without requiring attention, and it is certain that he accomplished it in a very creditable and ingenious manner.

Coming now to the time of the commercial birth of arc electric lighting, we find Jablochkoff in the lead, closely followed by Brush and Wes-

ton, each making use of the cylindrical form of carbon pencil, and turning their attention most assiduously to the feature of continuity of operation, the first move being an increase in length of the pencils. Carre, a French manufacturer, at this time, became prominent as a maker of carbons, and succeeded in producing pencils about 7_{16}^{1} inch diameter, and 32 inches in length, and it was thought by the use of lamps of suitable length, these long carbon pencils could be advantageously used when long continued burning was a necessity; but owing to the difficulties encountered in the manufacture, and also trouble in maintaining proper alignment for the carbons, a length of 22 inches was soon settled upon as most practicable and convenient.

As the business increased and the demands became better understood, the inventors again essayed to solve the problem of continuity of action, but in many cases such attempts were but returns to old forms and methods, and did not result in any practical advance.

Various forms of double carbon lamps were introduced, and for a time these were thought to be the only practical and commercially successful way out of the difficulty, but more recent developments have shown a far simpler and better way, and one, furthermore, that cannot fail to impress the practical electrical engineer. I refer to the simple expedient of using a carbon pencil of ⅜-inch diameter 14 inches in length in an ordinary single carbon lamp. It is true that this is not new, and that carbon pencils of such size, or even greater, were tried long ago; nevertheless, the introduction of carbons of this size and form has a very great bearing on the commercial side of the situation; but before going into that matter I wish to say a few words regarding the lighting efficiency of ⅜-inch carbons.

Having noticed that the question had been raised as to whether these carbons would give as much light for a given expenditure of electrical energy as would those of 1 inch diameter, I tried the following experiments:

Two single lamps were connected in series in an arc circuit, one being supplied with ⅜ inch carbons 14 inches in length, the other with ½ inch carbons 12 inches in length. Around each lamp was branched a voltmeter, indicating the voltage. The lamps were then adjusted until they had the same voltage, and as current was of necessity the same in each, it was a safe conclusion that equal amounts of energy were being supplied. Photometric comparison of the two lights was then made at the horizontal and at many different angles above and below, with the result that no perceptible difference could be found in the power of the lights. During the tests the current was maintained as constant as practicable, and care was taken to base the comparison on an average deduced from a large number of readings.

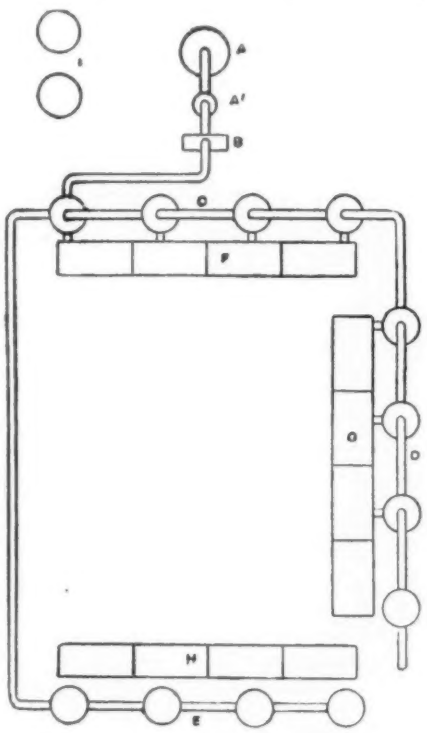
Now, while this matter of lighting efficiency is one that concerns the people operating electric plants, it does not interest them to the extent that other features upon which I have yet to touch may, as I happen to know that the management of lighting stations look long and lovingly on any plan that seems to give good promise of reducing running expenses. To begin with, there is the difference in first cost between a single and a double carbon lamp, and the difference in the expense for repairs and attendance; these items varying, of course, with the different lighting systems. Still another important saving is in the cost of carbons—the cost for a given number of hours run being fully 30 per cent. greater with ½ inch than with ⅜ inch carbons. There is the further important saving in the breakage of globes, which often is caused by the sudden shifting of the arc in the double carbon lamp. Twin carbons, consisting of two cylindrical pencils placed parallel and in close juxtaposition to each other, and connected by a web throughout their entire length, have of late been introduced, and when in use the arc alternates between the different pencils comprising the upper and lower twin carbons. A test of these carbons, made principally with a view of determining the life and lighting quality, gave unsatisfactory results in the following particulars: It was observed that the duration of burning for a given weight of material was not near equal to that which could be obtained with the same amount of material in a single cylindrical pencil. This I attribute to the more rapid disintegration of the twin carbon, resulting from the very frequent heating and cooling of each member. Indeed, this is found to be true of two carbons when arranged as in the Day lamp, or so that the arc alternates frequently between the different sets; and there is quite a noticeable difference in consumption of carbon for a given duration of lighting as compared with an ordinary single carbon of the same diameter burning without interruption.

Another undesirable feature of twin carbons is the shadow cast by the non-burning members, which, while it may not be disagreeably noticeable when the lamp is provided with an open globe, most certainly operates to reduce the total output of light.

It may be argued that the main item of expense in the manufacture of carbons does not lie in the material, and the fact that ⅜ inch carbons cost so little more than ½ inch would bear out such a position; and I have merely mentioned the fact of the rapid disintegration and burning away of the twin carbons by way of explanation.

The Simpson Alkali Process.

Industries calls attention to the erection, at Widnes, England, of research laboratories by the United Alkali Company as indication that the Company is fully aware that fresh changes may still be rung on the old Leblanc process. Mr. James Simpson, of Liverpool, has evolved one of these changes, and patented a new process, which combines the manufacture of carbonate of soda with that of concentrating the phosphate of lime minerals. No ammonia is required in the process, and no



tank waste is produced. The inventor, by amalgamating the manufacture of carbonate of soda and sulphate of lime with that of phosphate of lime of high strength, succeeds in obtaining these substances in a more economical manner than has ever been done hitherto. There are four distinct operations involved in the new process.

The ground phosphatic mineral, previously wasted, if it contains carbonate, is suspended in water, and a current of sulphureted hydrogen passed through the mixture. The free lime and that which existed as carbonate present in the mineral passes into solution as calcium sulphydrate, and the mineral has its weight reduced proportionately, and percentage of phosphate of lime in it thereby increased.

$$CaO + 2HS_2 = Ca(HS)_2 + H_2O.$$

After the solution of calcium sulphydrate is removed, the phosphate of lime can be dissolved by a mineral acid and separated from the silica and silicate of lime which it may still contain. The quantity of acid required for this operation is obviously far less than that required for the untreated slag. Hydrochloric acid of about 10° Tw. is used for this operation. The acid solution of nearly pure phosphate of lime obtained in this way is then neutralized by hydrate or sulphydrate of lime solution, and high strength phosphate of lime is precipitated. The calcium chloride liquors are run to waste, while if sulphydrate of lime is used for this operation the sulphureted hydrogen evolved is used for brimstone or vitriol manufacture.

The third operation consists in treating a solution of neutral salt cake, obtained in the ordinary way from salt and sulphuric acid as in the first part of the Leblanc process, with the calcium sulphydrate solution formed in the first operation. The reaction that then takes place may be thus represented, and is facilitated by conducting the operation under steam pressure of 60 lbs. to 70 lbs. per square inch:

$$Na_2SO_4 + Ca(HS)_2 = CaSO_4 + 2NaHS.$$

The sulphate of lime is thrown down in such a condition as to render it available for the manufacture of plaster of Paris or pearl hardening

for paper manufacture. It may also be utilized as gypsum for agricultural purposes. The solution of sodium sulphydrate is then heated in a series of Solvay's towers or other carbonating apparatus with carbonic acid gas until the bicarbonate is precipitated.

$$NaHS + CO_2 + HO_2 = NaHCO_3 + HS_2.$$

The sulphureted hydrogen evolved is employed for the treatment of a further quantity of the mineral or slag in its first operation. It will be noticed that theoretically there is no loss of sulphur involved in this process, but in practice it is found necessary to compensate for a small unavoidable loss by the addition of Leblanc alkali waste or reduced sulphate. The carbonic acid employed in the carbonating operation is produced by burning limestone in a lime kiln with coke, the gas being drawn from the soda towers, when sulphureted hydrogen is evolved at sufficient pressure to pass through the sulphydrate vessels, the nitrogen from the last vessel passing through the milk of lime scrubber and an oxide of iron bed to eliminate any trace of sulphur before it escapes in the air.

In the accompanying diagram *A A* represents the lime kiln and scrubber, and *B* a blowing engine. The lime kiln gases pass into the sulphydrate of sodium in the vessel *C*, the liquors run through the filter bed *F*, whilst the sulphureted hydrogen evolved is absorbed in the series of vessels *D* containing the ground mineral and water (the furnace *I* roasts the mineral if necessary). The liquors from *D* are filtered through the filter bed *G* from the insoluble phosphate, and is then mixed with the salt cake in the vessel *E*, filtered from the sulphate of lime by the filter bed *H*, and passes back into the carbonating vessels *C*.

The phosphate obtained by this process is practically pure tricalcic phosphate, containing 55 to 56 per cent. of phosphoric acid; and as the highest grade natural phosphates seldom exceed 83 per cent. of tricalcic phosphate, the product will be found much more advantageous for manure manufacture than anything at present in the market. The inventor believes that the profit resulting from the enrichment of the low grade phosphate is more than sufficient to pay the cost of the alkali. In other alkali processes the gross cost of the alkali is far greater than the returns from the recovered bye-products.

Analysis and Cost of Rose Fuel Gas.

The *American Manufacturer* furnishes the following figures respecting the showing made by the Rose fuel gas process at the works of the Bellefonte (Pa.) Iron and Steel Company, where the fuel is used for puddling purposes. The appended analyses figures, showing the composition of the gas, were deduced by Dr. E. G. Love, of this city:

	Per Cent.
Hydrogen	44.67
Marsh gas	14.50
Carbonic oxide	15.35
Heavy hydrocarbons	5.30
Nitrogen	18.83
Carbonic acid, etc	none
Oxygen	1.35
	100.00
Calorific power at 60° F. and 30′	470.05 units.

The tests of the plant at Bellefonte were made for Messrs. Carnegie, Phipps & Co., by Mr. T. B. Lee, M.E., 91 Fifth avenue, Pittsburgh, who made a very careful running test of the producer to determine with accuracy the cost of the gas, whose report in substance is as follows:

Data of 12-Hour Test of Gas Producer Plant, August 17, 1891.

Started at 7:53 A.M and stopped at 7:56 P.M.	Gas made in 12 hours 3 minutes	234,650 ft.
Oil used, 395 gallons, at 2¼ cents per gal.		$8.89
Coal used, 2,464½ lbs., at $1.50 per ton..		1.72
Coke used, 1,045½ lbs., at $2.25 per ton.		1.06
Labor, two men, $1.75 and $1.50 per day		3.25
Steam (from B. I. & N. Works, estimated)		.50
Water " " " "		.25
Total cost of gas		$15.67
Cost per 1,000 ft. of gas, 6.68 cents.		

At the beginning of the test the chambers of the producer were full to the doors, and at the finish they were filled to the same point with the measured coal and coke, by which the exact amount of solid fuel consumed was determined. Each barrow of coal and coke was weighed as it was brought on the platform, and each barrel of oil was carefully measured. The gas tank was accurately gauged by meter, and lines marked on, between which 3,000 ft. were contained. This measure was filled and exhausted 86 times, and the total discounted 15 per cent. for possible contraction due to fall of temperature, making total production 234,650 ft. The producer made gas constantly for 12 hours and 3 minutes, with no waste at any point. The prices given in the tabulated data above included freight to Bellefonte, and were given by the clerk of the Bellefonte Iron and Nail Works.

In making a comparison of what the cost of this gas was at Bellefonte and what it would be in Pittsburgh, the following facts may be noted: First, Lima oil, which is a large factor, costs at Bellefonte 2¼ cents per gallon, while in Pittsburgh the Standard Oil Company will contract to furnish it for one year in any quantity at 1.41 cents per gallon, and have done so with at least one Pittsburgh firm. The item of coal would further reduce the cost here. Slack, which would fill all requirements, can be had here for $1 per ton at an outside figure, while at Bellefonte it was charged at $1.50. It is plain that the cost can easily be brought here to below 5 cents per 1,000 ft. It has been found that with regenerative puddling furnaces the consumption of gas does not exceed 20,000 ft. per ton of iron, bringing the cost of fuel for puddling to within the limits of $1 per ton.

SPECIAL ENGLISH CORRESPONDENCE.

COMMUNICATED BY NORTON H. HUMPHRYS.

WEYMOUTH, Sept. 10, 1891.

Testing Coals.—Value of Gas Stocks and Shares.—Inclined Retorts.—A Metallic Gas, etc.—Mr. G. Livesey and the Quality of London Gas.

The Belgian Association of Gas Managers have adopted the plan of directing attention, at their usual monthly meetings, to one subject only. The committee select a matter of importance and general interest to the members, and name a member to write a paper on the subject, the same being read and discussed in the usual way. Assuming that all the members are so far interested in the objects of the Association as to attend the meetings and take part in the discussions, thus affording the committee an opportunity of judging the individual knowledge and experience of each one in respect to every detail of the gas engineering profession, such a plan seems to possess the advantage of drawing out the best and most authoritative information available in regard to the particular subject in view. But in England we have men who seem to be satisfied with paying their subscriptions and getting a volume of the transactions. They have a vague sort of idea that their name on the members' roll assists in supporting the Association, and if such was absolutely necessary would come forward rather than allow it to fall through for want of support. As it is, they rarely trouble to come to the meetings and the burden falls upon those who are willing to bear it. The voice of the individual belonging to the class just indicated may be quite unknown to his fellows. With a large number of such persons to deal with, the committee would be hampered in the proper allocation of subjects. But this is a matter that would right itself after a time, provided that every member accepted the fact that his obligations to the Association include taking part in the proceedings when requested to do so.

As an example of the class of subjects dealt with by the Belgian Gas Engineers, it may be mentioned that "the testing of coal" was the topic submitted at a recent meeting. A paper was read enumerating the present state of knowledge on this interesting question, and in the course of the subsequent discussion a great deal of stress was placed on the importance of publishing the fullest possible details of the tests obtained at different gas works. Perhaps on this point matters stand in Belgium in a similar position to that occupied by them here. All our largest class of gas undertakings employ competent chemists and provide suitable laboratories for the complete examination of the coals and all other materials used by them. But the results so obtained are considered to be the property of the company, taken for the use of the engineer, and there is a great reticence as to publishing. Many who would gladly place the same at the disposal of brother gas engineers would hesitate about scattering them before the public through the medium of a Gas Managers' Association. Some provincial newspapers, I am told, practice a system of "exchanges," and it has several times been suggested whether the Gas Managers' Association could not be made the means of circulating special information between the members, such as statistics and other things that concern themselves rather than the public generally. It will hardly be denied that a record of the practical results obtained at all the neighboring gas works would be a great help to any gas engineer.

So far as one may judge from the quotations of gas securities in the stock and share markets, the public confidence in the value of gas property is unabated, notwithstanding the increased price of coal, and the advance, both real and alleged, of the electric light. This is remarkable when we remember that some of the gas companies, during the last year or so, have had to look to the reserve fund for a large part of their dividends, and the general impression that coals will not fall to any important extent below their present rates. As to the electric light, it has been allowed sufficient rope and has, to a certain extent, hanged itself. Whilst the consumers are complaining loudly of the high prices charged, the electric light companies are not able to pay dividends and are not likely to do so at the present prices. These, by the way, are said by the well known Mr. W. H. Preece and such like enthusiasts, to be "30 per cent. dearer than gas;" but by consumers (who judge from the practical point of the account rendered), to be four times as much. Many of the first-class gas securities paid purchasers who are satisfied to get less than 4 per cent. on the money so invested, and the shares of any well conducted undertaking will be taken up for less than five per cent. For example, the latest quotations for debentures in the Commercial Gas Co. (London) show £3 12s. per cent. Some preference shares in the Continental Union have realized at £3 10s., and debentures in the South Metropolitan, £3 9s. Several classes of the Gaslight and Coke Companies' capital fetch equally high prices.

A sub-committee of the Salford Corporation Gas Committee, who have visited several gas works where inclined retorts are in use, appear very favorably impressed with that system, and if the opinions formed by these gentlemen can be substantiated in practice, there is no doubt as to the rapid progress and adoption of this method of retort setting. Amongst other advantages claimed, there is a saving of 50 to 60 per cent. in labor, with less exposure to heat for the men and less dependence on personal skill, so that the plant could be worked just as well by inexperienced laborers as by workmen specially trained. These are solid advantages with some extra expenditure in the way of first cost, etc. For making gas on a small scale the cost of additional brickwork, building, elevating machinery, etc., is an important item, not to be undertaken until the success of the system has been absolutely proved by experience. An important feature of the system is the fact that it does away with the restrictions both as to length and section of retort that appear to be inseparable from the ordinary horizontal arrangement

It has recently been shown that if pure carbonic oxide is passed over metallic iron in a state of very fine division and slightly warmed, chemical combustion ensues. The compound gas so obtained burns to a brilliant white luminous flame, and a metallic deposit of iron may be obtained by holding a cold porcelain surface in the flame. This deposit is soluble in hydrochloric acid, and the solution gives the reactions usual for iron. The iron used for the experiment must be perfectly free from oxide, and may be prepared by reducing dried precipitated ferric oxide, obtained by the ignition of ferrous oxalate in a current of pure hydrogen.

This new gas has been called iron carbonyl, and while not likely to be of use as a commercial illuminating gas, the fact that iron may be carried by a non-luminous gas just like heavy hydrocarbons, is of great interest, and will no doubt be turned to good purpose in the arts. While on scientific subjects, I may also direct attention to another important fact that has been observed, and that is the action of alkaline solutions upon the illuminants present in gas. It is a very common practice to estimate the carbonic acid in gas by absorption, agitating it with a solution of potash in a burette, or in a separate vessel, as on Hempel's system. In either case the result would be too high, as besides the carbonic acid, some of the hydrocarbons would be absorbed. Some years ago I found that the burette gave 0.5 to 1 per cent. more carbonic acid than that obtained by using a standard solution of baryta, and either titrating the solution or weighing the precipitate. Further, it is possible that careful experiments would show that but few of the absorption methods are strictly accurate. I have yet another scientific note that may be interesting. Dr. Mills and Mr. McMillan have been conducting a long series of experiments on destructive distillation, and they find that when coal is distilled at a high temperature about five-sixths of the total carbon present in the coal remains behind in the retort as coke. Of the sixth that is volatilized, one third goes to the tar well and the remainder to the gas. At a low temperature, nine tenths of the carbon are left behind, and the volatile part is equally divided between the tar and gas. So that at the high temperature, about twice as much carbon goes into the gas as at the low temperature. At the low temperature the yield of gas was 3,589 cu. ft. per ton, specific gravity 0.537; and at the high temperature 10,089 cu. ft., specific gravity 0.403.

Mr. Geo. Livesey, the Chairman of the South Metropolitan Gas Company, has addressed a letter to the London County Council on the subject of the arrangements at present in vogue for testing the London gas supply. He commences by directing attention to the fact that the competition of other illuminants renders the companies anxious to keep up the illuminating power of the gas, apart from the supervision exercised by the officers of the Council; whilst the sliding scale arrangement is to render the Company a direct interest in keeping down the price. After a glance at the difficulties under which the gas industries are at present laboring, he goes on to show that anything in the way of forcing the suppliers to raise the quality of their gas is not necessarily an advantage to the customer. On account of the high price of cannels and first-class gas coals, the increase in quality may necessitate a disproportionate increase of price. A large proportion of the gas supply is used for purposes other than lighting, and therefore the result may be dearer gas to the consumer, instead of cheaper. The officers of the Council have followed such a course by introducing "improvements" in the photometers used, and by making alterations in their ways of testing, etc., that have the effect of rendering it necessary for the companies to send out a gas of 1½ or 2 candles higher illuminating power than formerly, although the quality nominally remains the same. Under these circumstances Mr. Livesey thinks there is room for a better understanding on the subject, and that quite as much on behalf of the consumers as the shareholders.

Economies of Iron and Steel.

The London *Builder* says that such extensive use is now made of iron and steel for structural purposes, that a considerable knowledge not only of what can be manufactured and readily obtained, but also of the leading principles and practices of the industry is becoming more and more necessary to the engineer and architect who have to use these materials. A brief examination of the average specifications relating to iron and steel work is sufficient to show that much greater uniformity might be observed in the requirements of engineers regarding the quality of the material they demand for various purposes; and the designs for structural work in many cases exhibit so many different forms and sizes of rolled sections, that much delay and extra expense is caused by the difficulty of obtaining such from the manufacturers within a reasonable time.

Mr. H. J. Skelton, in his book on the "Economies of Iron and Steel," has attempted to make clear the best every-day practice in the heavy iron and steel trades, to those whose province it is to deal with the material after it is made." It is not therefore a book for the manufacturer, but for those who are responsible for the proper application of the materials. From the first page to the last the subject has been treated in a clear and workmanlike manner, and we know of no book that could be studied with greater advantage by those who use, or are interested in, the products of the iron and steel industry.

The work is naturally divided into three parts. "Cast iron," "wrought iron," and "steel." The manufacture of each, and the forms in which it can be obtained, are described, and the most approved tests which each material should stand to insure it being of a suitable quality for the purpose for which it is intended, are also given at some length, and form a useful portion of the book. Since it is now possible by the "basic" process to utilize phosphoric pig iron, nearly one-half of the crude iron produced in Great Britain is converted into steel, and excellent material can now be made from metal taken direct from the blast furnace to the Bessemer converter. Of the pig iron now made only a small quantity is produced by what is known as the "cold blast," as the greatly increased price of material made in this way prevents its being used except where its superior quality renders it necessary.

The ordinary test for cast iron which is to be used for structural purposes is, that a specimen bar of the material 2 in. deep, 1 in. wide, and 3 ft. 6 in long, placed on bearings 3 ft. apart, should withstand a load of from 25 cwt. to 30 cwt. applied at its center, before breaking. Such a test however does not insure the metal being sufficiently ductile for many uses, and we quite agree with the author, that better cast iron is secured if it is specified that the above test bar must deflect not less than from ¼ in. to ½ in. before fracture. Specimen bars should also be tested that have a thickness equal to the thickest part of the casting, the quality of which they are intended to exhibit.

In dealing with wrought iron the author first describes what is known as "best Yorkshire," which is the best possible iron that can be obtained, being made from a superior quality of cold blast pig iron, and a fuel practically free from sulphur. Lowmoor and Bowling iron are examples of best Yorkshire iron, but there are other brands which denote qualities of equal excellence. Material of this class is used in the bo-

ers of locomotives and other engines, in the couplings used on railways, and generally where sudden stress may be expected, and when any failure might be attended with disastrous consequences. Other qualities of iron are made in Staffordshire, Shropshire and other counties, but it is wiser to specify the tests that the material will be required to stand, than to name the locality from which it is to be procured.

In dealing with the tests for wrought iron, the author lays great stress upon the necessity of specifying what amount the reduction of area at the point of fracture of the test piece should be, as well as what elongation is required, in addition to tensional strength, and he also points out that the appearance of the fracture of a piece of iron must not be taken as too sure a guide to its quality, since it is quite possible to make a bar of excellent material show a crystalline fracture, due entirely to the manner in which it has been broken.

One-half of the book has been devoted to a description of steel, and the Bessemer and open hearth processes, in which pure pig iron is used, are explained, as well as the "basic" method, which permits phosphoric pig being utilized. To the uninitiated the distinction between wrought iron and steel is not very evident when the chemical constitution is alone considered; but when it is remembered that wrought iron is produced by welding together a number of small pieces, which have never been thoroughly fused, while mild steel has been completely melted before being cast into ingots, the difference between the two materials is easily realized.

In dealing with mild steel greater care must be exercised than is necessary in the case of wrought iron. As stated by the author, all sheared edges of plates should be afterward planed, and all holes should be drilled. In some cases, however, when the thickness of the material does not exceed three-eighths of an inch, we think punching might be allowed, although it should never be permitted in thick plates. In designing structures in iron and steel it must not be forgotten that while the cost of the steel may be somewhat greater than that of iron, and that extra expense is incurred through the more careful treatment necessary in the workshop, yet these outlays may be more than counterbalanced by the reduction that may be effected in the weight of the structure, owing to the increased stress per square inch that is allowable, as well as by the much larger sizes of the plates and rolled sections that can be obtained in steel.

It is essential, when specifying the quality of steel required for structural work, not only to state the least strength per square inch that the material must have, but to require also that its strength shall not exceed a certain limit. The range allowed between this maximum and minimum strength is generally from 3 to 5 tons.

The author adds considerably to the value of his work by giving a comprehensive list of those tests which are at the present day recognized as the best that can be applied to steel to secure a quality that is suitable for the purpose for which it is to be used, and he also gives many useful tables showing the sizes of rolled sections and plates that can be ordinarily obtained, and the extra price it is necessary to pay if these limits are exceeded.

In conclusion, we have confidence in recommending this work to engineers and architects, who will find it contains much that will be useful in everyday practice, as well as being a book which gives a clear and able description of the modern iron and steel industry.

Coal Raised from Deep Mines.

The question of the depth at which coal may be worked is of increasing importance to England, and it has received a practical answer in one of the recent reports of the inspector of mines. The report of Mr. Robson, the inspector for the important South Wales district, contains a table showing the output of coal from different depths in that district, in the past year. No fewer than 163 mines in that great district produce coal from a depth of not less than 100 feet out a total of 357 mines in the district. But though this was much more than a third of the total number of mines, yet the output was only about one-eighth of the total yield of the district. It is not until we come to a depth exceeding 600 feet that we arrive at the mines of large output in South Wales. Fifteen mines above that depth and less than 700 feet each yield on the average 110,000 tons each; then of a still greater class, five mines of between 1,100 feet and 1,200 feet in depth, yield each over 200,000 tons. Twelve each of 100 feet deeper class yield 214,000 tons each, and four of the deepest mines are amongst the most productive. These mines vary from between 1,600 feet and 1,700 feet to between 2,100 and 2,200 feet each, and the four are grouped together in the return, the total output being 1,214,581 tons, or an average of over 318,000 tons each. This report of the inspector is one that is most valuable, and whilst it is so given that the output of an individual colliery cannot be learned by the reader, it yet enables an idea to be formed of the depths at which coal is being wrought in the great district to which it refers. Roughly speaking, it would appear that less than one-half of the coal that is raised in South Wales is from a depth of over 1,000 feet; whilst about a twelfth part of the total is raised from the depth of over 1,500 feet. It is quite evident, then, that there is now a very deep working of coal—deep to what used to be the case—in South Wales. But there is still nearly a third of the total output raised from mines with a depth of 500 feet or less; and the mines between that and 1,000 feet are about as productive, so that the yield is from mines of very varying depth. It would be well if we could have similar tables in future years from the other coal-producing districts of the United Kingdom, for valuable data might be drawn from a comparison. It would be unwise to draw deductions from the isolated facts as to one district; but if we had the returns for the whole of the country, conclusions might be more safely drawn as to the relative safety of mines worked at different depths. This is a subject that has been discussed at different times, and the extent of the yield at varying depths would certainly be one of the factors that need to be taken into account before any trustworthy conclusion can be come to on that most important matter.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

THE proprietors of the Pulaski Gas Light Company, of Little Rock, Ark., have applied to the City Council for an extension of the exclusive franchise to furnish gas in that city for a further period of 25 years. In return for the concession they agree not to charge in excess of $2.50 per 1,000 cubic feet for gas sold to the residents. The application was referred to the Ordinance Committee.

AT a recent meeting of the Street Commissioners of Saratoga Springs the matter of reducing expenses for lighting the village was taken up. Messrs. Pond and Wells, who had been instructed to look into the question, reported that 71 arc lights could be cut off, these to be replaced with 84 gas and 3 naphtha lamps. The report was adopted.

THE proprietors of the Nashville (Tenn.) Gas Company have notified the consumers that hereafter the gross rate for illuminating purposes is to rule at $1.60 per 1,000 cubic feet, all gas used for cooking, heating and power purposes to be billed at $1.45 per 1,000. On all classes of consumption a rebate of 10 cents per 1,000 is allowed if accounts are settled 5 days after the bills are presented.

THE Council Committee on Lights, Wheeling, W. Va., has reported in favor of supplying gas to the St. Alphonsus Orphan Asylum free of charge.

THE Lynn (Mass.) *Item* reports that an interesting question involving the right of gas and electric light companies to erect and maintain poles in the streets of cities and towns of Massachusetts is before the State Supreme Court, a suit having been begun by the Attorney General at the relation of the Gas and Electric Light Commissioners against the Walworth Light and Power Company. In 1887 the Legislature passed the act providing that where in a city or town a gas or electric light company existed no other company should be allowed to erect or maintain poles without first obtaining permission of the aldermen or selectmen. The defendant was chartered in 1888, and soon afterward put up poles and wires and began to do business in Boston. After a time the Company applied to the Board of Aldermen of Boston for leave to erect poles, and the petition was denied; whereupon an appeal was taken to the Board of Gas and Electric Light Commissioners, who sustained the Aldermen. Some of the defendant's competitors complained to the Commissioners, and the latter served notice that its poles and wires must be taken down. As the order was not complied with, an information was brought with the result that Attorney General Travis appeared before Judge Morton on behalf of the Commissioners. The Walworth Company contends that the act is unconstitutional.

THE Wilmington (Del.) City Electric Light Company has, in a complaint to the Board of Street and Sewer Directors, called attention to the great loss sustained by the Company in the wilful destruction of the incandescent lamps maintained by it in the public lighting of the city. The value of the property destroyed so far amounts to several hundred dollars. The Board replied that a standing reward for the arrest and conviction of persons found interfering with the public lamps was offered, and the Company has appealed to the Police Department to keep a vigilant lookout for offenders of the type noted.

THE St. Catharines Water Works Company, of St. Catharines, Canada, is suing the St. Catharines and Welland Canal Gas Light Company for arrears of water rates, amounting in value to $5,983.

THE Committee on Lamps of the Cambridge (Mass.) Council has been authorized to renew the contract with the Cambridge Gas Light Company for 300 or more gas lamps, for a term of three years, at the rate of $1.20 per 1,000 cubic feet, which is 15 cents per 1,000 cheaper than the supply under the former contract.

DR. N. H. SCHILLING has handed in his resignation as Manager of the Munich gas works, his health being such that absolute rest is enforced upon him by his physicians. Dr. Schilling has been in the service of the Munich gas works close on to one-third of a century. His place will be taken by Herr Lothar Diehl and Dr. Eugene Schilling.

WE regret to announce the death of Mr. Amos J. Bicknell, publisher of the *Architectural and Building Monthly*, at his home in Elizabeth, N. J., on the morning of September 21st. Deceased was born at Webster, Mass., in 1839, and located in Elizabeth in 1871, where he was much esteemed. He was one of the Vice-Presidents of the Elizabeth Board of Trade.

THE total quantity of kerosene imported into Bombay, India, in 1889–90 was 13,074,072 gallons, against 11,930,739 gallons in 1888–89. Of this amount 10,742,344 gallons were shipped from Batoum, Russia, while only 2,961,728 gallons were imported from the United States, or, respectively, 77 and 23 per cent. Four years ago, only 1,481,232, gallons came from Russia, and 5,871,581 gallons from the United States, or, respectively, 20 and 80 per cent.; so that in four years the positions of the United States and Russia in the Indian oil trade have been practically reversed.

WE are indebted to Mr. Magnus Ohren, Secretary of the Crystal Palace District Gas Company, of London, England, for a copy of the Directors report of the workings of the Company for the half year ended June 30th, 1891. The showing on earnings account is not so favorable as the proprietors could wish, but the decrease in net profit is chargeable mainly to the increased price paid for coal, abetted by the higher wages received by the laborers. The sendout for the 6 months compared with the corresponding half of 1890 shows a gain for the former of 12.87 per cent., the last quarter, however, averaging but 9.67 per cent.

"OBSERVER," writing under date of September 19th, forwards the following clipping, which explains itself. "The special committee appointed by the Mayor of Haverhill, Mass., to investigate the practicability and advisabilty of the city's establishing a municipal lighting plant has made its report. In order to arrive at a reliable and intelligent conclusion the committee investigated the matter at great length and examined a large mass of facts and figures bearing upon the subject. It has been in communication with many cities and towns, some owning their electric plants and others lighted by private parties under contract. As the result of these investigations the following facts are presented by the committee, which will prove of general interest to the towns and cities that contemplate taking advantage of the provisions of the act passed by the last legislature relative to the establishing of such plants by Massachusetts municipalities. The average price paid in 62 cities to private parties is $105.13 per light per annum and the same services performed by and directly under municipal control in 14 cities costs $55.12 per light. The first and only conclusion to be drawn from a study of these figures is that cities can furnish their own electric lighting more cheaply and advantageously than it can be procured from private parties. Using the figures given by 80 cities and towns throughout the United States, where the population is 10,000 and upwards, we find the maximum cost per annum per light to be $401.50, the minimum cost per annum per light to be $44, and the average cost per annum per light to be $103.20. These prices are for arc lights of 2,000-candle power, the same as in use at Haverhill. Our city is now paying $154.31 per light per annum, at the present time a sum more than 30 per cent. in excess of the average cost per annum, as given above. The committee gives the following estimate in detail of the cost of an electric light plant for the city of Haverhill: Installation of an arc light plant, as per specifications submitted, $9,969; fixtures and machinery, for incandescent lighting of city hall, etc., $2,690; steam plant, boiler, engine, etc., to include a 150-horse power compound condensing engine, $8,849; 40 mast arms, at $34 each, $1,360; sundry expenses for location of building, etc., $6,175.50; cost of building, boiler room, chimney, etc., $3,500; for contingent expenses, $1,700—total, $35,035.50. The cost of operating above plant would be 5 per cent. interest on $35,000 capital invested, $1,750; 5 per cent. per annum for depreciation and repairs, $1,750; 300 tons of coal, at $5.50 per ton, $1,650; salary of engineer, $900; ditto, of fireman, $600; ditto of trimmer, $600; of helper, $400; supplies, $350—total expenses per annum, $8,000. The figures submitted are from actual estimates, and as the committee is confident that the entire plant can be built and put into good running order for the sum named, it recommends the city to engage at once in the work of construction."

THE Franklin (N. H.) Gas and Electric Light Company has been authorized to light the streets of that town, for a 5-year period, by means of arc lamps.

ALDERMAN MCGOVERN, of Hartford, Conn., recently introduced a resolution in the Board directing the Mayor to designate the times and places when gas inspections shall be made, instead of the practice hitherto followed. He urged the passage of the resolution on the ground that the "gas was now so good that regular inspections were not necessary." Ald. Preston moved to indefinitely postpone the resolution, which was defeated, and the resolution was adopted.

AT the annual meeting of the Worcester (Mass.) Gas Light Company a good representation of the shares is reported. The reports of the President and Treasurer showed a satisfactory increase in business for the year. New consumers, to the number of 400, were taken on, and about 200 gas-stoves were placed. The improvements on plant consisted in the construction of a water gas annex, with the necessary station meter, relief holder, etc.; a stack of new benches was placed in the retort house, and three miles of street mains were laid. The Directors chosen were: Charles D. Lamson, A. George Bullock, Joseph E. Davis, Waldo Lincoln, Josiah H. Clarke, Francis H. Dewey and Joseph Sargent. The Directors subsequently effected the following permanent organization: President, Charles D. Lamson; Clerk and Treasurer, James P. Hamilton.

THE authorities of Wilmington, Del., have awarded a contract to the local Gas Company for the lighting of 900 or more gas lamps, on city lighting account, at the rate of $16.62 per lamp, the contract to last for five years.

THE plant and stock of the Van Wie Gas Stove Company, at Rockford, Ills., are in the custody of the sheriff, on account of judgments confessed.

FRED. BREDEL reports a very busy season, his contracts on hand amounting to many thousands of dollars.

PITTSBURGH, Pa., is now agitating the matter of engaging in the business of electric lighting supply on municipal account, and this intent is all the more surprising when one remembers that the adjoining borough of Allegheny City now complains that the electric lighting plant installed on municipal account is anything but up to the expectations of its promoters.

SEALED proposals for the piping for gas supply and the wiring for electric lighting service for the new buildings now underway at San Bernardino, Cal., which are to give shelter to the unfortunates committed to the care of the Trustees of the Southern California State Asylum for the Insane and Inebriates, will be received, up to noon of October 12th, at the Farmers Exchange Bank Building, San Francisco, Cal.

THE death of the Hon. W. L. Scott, which event had been feared for some months, occurred at midnight, September 20th, at Newport, R. I., where he had gone some weeks before at the advice of his physicians. The direct cause of Mr. Scott's death was heart failure, superinduced, no doubt, by the gastric troubles from which he had long been a sufferer. Owing to Mr. Scott's prominence in the gas industry, as proprietor of one of the greatest gas coal collieries in the world—the Ocean Mines—the following particulars respecting his eventful career will be read with interest. Premising these with the remark that we are indebted largely to Mr. James D. Perkins, of this city—who has for years, with his associates, represented Mr. Scott's gas coal properties—for our compilation, we find that "William Lawrence Scott was born in Washington, D. C., on July 2, 1828. His father had been graduated at the West Point Military Academy, and at that time was an officer of the regular army stationed at Washington. The grandfather of William L. Scott was Gustavus Scott, a native of Prince William county, Va., who died at Washington, D. C., in 1801. The father of Gustavus was the Reverend James Scott, a Scotchman, who became a minister of the Church of England, and accepted a living in the province of Virginia, about 1730. Gustavus Scott was educated at Kings College, Aberdeen, became a lawyer

and practiced in Somerset county, Md. He was a man of marked ability and much influence in affairs associated with the war for American independence. From him William Scott, it may be assumed, inherited many of those aggressive qualities which have given him prominence in the world of trade and politics. His father was of delicate physique and died when the subject of this sketch was a stripling, leaving the mother far from well provided with means. In fact, she was obliged to struggle for an existence for herself and small family. She was a woman, however, of much courage, with the responsibilities of her position fully appreciated. Even as a boy Mr. Scott was active and shrewd, and at 12 years of age he secured an appointment as page in the House of Representatives, where he continued to serve for six years. Meanwhile he availed himself of meagre common school facilities which the city of Washington then afforded. He cared little, however, for books, preferring the larger excitement associated with business affairs. While serving as a page he attracted the attention of the representative in Congress from the Erie (Pa.) district, Charles M. Reed, a merchant who was largely interested in the rapidly developing commerce of the great lakes. As a result, in 1848 young Scott removed to Erie, where he became a clerk in the office of his friend and patron. It was a propitious beginning for a youth of Mr. Scott's business tastes and talents, which were conspicuously in the direction of trade. He was methodical by instinct, and his judgment was rarely at fault. Two years had barely elapsed before he was launched in business undertakings on his own account. In these days there were many settlements along the line of the old Pittsburgh and Erie Canal, and Mr. Scott determined to supply them with salt fish. The white fish caught in the upper lakes he could transport at small cost to Erie, where they would meet salt brought from Buffalo at small cost. Thus he began the work of packing and selling fish, and he made frequent excursions into western Pennsylvania and along the canal. Soon, however, he turned his attention to trading in coal for shipment over the lakes, and in a short while he became a vessel owner and engaged in inland commerce. Along about this time the rapid development of the gas industry in the West and South brought about a demand for rich gas coals, and Mr. Scott was fortunate in his selection of a staple coal for shipment, and his gas coals were soon known along the settlements, rapidly growing into huge cities, located on the Western and Southwestern waterways. It was a natural sequence that he should become interested in other ways of transportation, and his capital found its way into other means of transporting his coals than over the changing beds of rivers. About 1879 Mr. Scott purchased at auction the mining property on the Youghiogheny river which had been spasmodically operated by Mr. Thomas Moore, his original purpose having been to utilize the product of this colliery (the coals from which were recognized in the trade as of high grade for gas making purposes) for his general lake supply. In 1880, however, through an adept and well planned scheme of water and rail highway, this coal first made its appearance upon the Eastern markets in what may be considered large quantities, and since that entrance the Ocean Mines Youghiogheny coal has figured as a very important factor in the Eastern gas coal trade of the United States, the annual shipments East ranging from 150,000 to 200,000 tons. Subsequent to the purchase of the Moore property Mr. Scott added largely thereto by the purchase of additional coal areas. In 1883 Mr. Scott organized the Youghiogheny River Coal Company, and transferred the operation of the Ocean Mine to that corporation. He was chosen President of the Company, with Mr. M. H. Taylor for Vice-President. The coal area of this Company is the largest on the Youghiogheny, comprising something over 4,000 acres. It might not be out of place here to say that the death of Mr. Scott will not interfere with the ordinary working of the Company. His determination to increase his railroad interests no doubt received great impetus from his marriage to a daughter of Mr. John B. Tracy, at one time President of the Chicago and Northwestern Railway Company, inasmuch as on the death of Mr. Tracy he became one of the executors of the estate. In his early railway experience he attracted the attention of Commodore Vanderbilt, and under the speculative influence always associated with that name he became a factor in Wall street, often being intrusted with the most important commissions in the manipulation of the market. He was a faithful disciple of his patron, and imbibed much of his spirit. He was always fond of repeating some word of advice given to him on many occasions by the old Commodore. They were these: 'Bill, don't you have nothing to do with them fellows that are always a takin' something up and never putting anything down.' Mr. Scott assiduously observed this item of advice throughout his life. At the breaking out of the war of the Rebellion Mr. Scott, though an ardent Democrat, with strong Southern sympathies, believed in the perpetuation of the union of the States as a nation. His position is best set forth in his own words: 'I believed I could be of more service to the Government by staying at home, so I organized the Scott Battery at an expense of $30,000. It was my idea that they could do much more good than I could as a private, or as a flinger of the sword of an officer, and so I let them go as my representatives.' In 1884 Mr. Scott was the Democratic candidate in the Pennsylvania district, comprising Erie, Venango and Warren counties. He was elected by a majority of 1,600 over the Republican, a Mr. Mackay, and was re-elected in 1886 over the same competitor. During his Congressional term he introduced a bill which provided for silver coinage to the limit of $20,000,000 per annum; also the bill levying a tax upon the manufacture of oleomargarine, which latter bill, with some modifications, became a law. He was a staunch supporter of ex-President Cleveland, and it is held by many that he was the one who inspired Mr. Cleveland to prepare his celebrated message on tariff reform. Some years ago he took an active interest in the breeding of racehorses, and his magnificent breeding and training farm at Cape Charles, Va., was the talk and wonder of the racing world. As with everything else that he undertook Mr. Scott attained eminence in his racing enterprises, the richest prizes of the turf falling to his share. The many victories won under his colors include the Futurity, Foam, Juvenile, Lorillard and other stakes, and amongst his contemporaries in the racing world—Messrs. Lorillard, Barnes, the late August Belmont, etc.—none stood more prominently for the honor of the turf than he. Mr. Scott was one of the most charitable men that ever lived, and always made every possible concession to the demands of labor, whose representatives he employed by thousands; and underneath his gruff manner pulsed a heart that was loyal unto the remembrance of the days when he felt the stings that poverty can bring. His wife and two daughters survive. The funeral services were celebrated on Thursday last, at his late home in Erie, Pa., amid circumstances and surroundings at once convincing that multi-millionaires may live in the hearts of their workmen as well as in the remembrance of their monied equals."

THE International Self-Closing Gas Burner Company has been incorporated, at Milwaukee, Wis., by Messrs. Charles Keeney, Isidor Leiser and C. K. Pier. It is capitalized in $100,000.

WE had a visit the other day from Mr. Stein "late of Philadelphia, but now of Waukegan, Ills.," and he is just as handsome and jolly as ever. The starch factory at Waukegan is completed, and only waiting for corn to come down to a figure "within reach" to start up. Judging, in the mean time, from fate that overtook the firm of S. V. White & Co., of this city, in their recent attempt to "bull" corn, we imagine that Mr. Stein's Waukegan factory will soon be grinding the golden grains.

THE Southern Gas Trust and Construction Company, which is presumed to have a large interest in the operation of the Palatka Gas Light and Fuel Company and the Ganesville Gas and Electric Light Company, both of Florida, has gone into the hands of a receiver. The Trust Company's headquarters were at Jacksonville, Fla.

THE residents of Pontiac, Mich., at a special election held on the 25th inst., agreed to authorize an issue of $14,000 in bonds, the proceeds thereof to be devoted to the installation of an electric lighting plant to be operated on municipal account.

THE 150-feet masts carrying arc lamps of a rated 4,000-candle power have been voted a failure at San Francisco. At least it would seem so from the action recently taken at a session of the Committee on Street Lights when, on motion of Mr. Tabor, it was agreed to report in favor of removing 8 of the 150-feet masts and to distribute the nominal illumination of the 4,000-candle lamps carried thereon at suitably located points. Masts 40 feet in height will be employed.

ACCORDING to the Boston *Advertiser*, a "well-known French electrician has invented a stove heated by gas or coke, which at the same time generates a thermo-electric current sufficient to charge an accumulator of 16 cells and feed a number of 10-candle power electric lamps. The electro-motive force of the current it yields is 35 volts, and the useful energy about 44 watts. The stove's peculiarity is that the wall is composed of 700 thermo-electric pairs, the hot joints being inward and exposed to the hot gases of the interior, while the cold joints are outward and provided with vertical flanges which help to cool them. Each pair consists of an alloy of antimony and zinc and a plate of nickel or white iron. The current is collected by similar wires and the fumes escape by a chimney."

The Market for Gas Securities.

Yesterday 100 shares of Consolidated gas were reported sold on the Exchange at 98½, and yet we know of a broker who has had an order for the past three days to buy the shares at 99, and he cannot get the stock. To-day (Friday) the bid rate was 98½, offered at 99½. There is no change in other city shares. Over in Brooklyn the situation remains unchanged, the managers of the Companies having determined to settle the question of future dividend rates when they have secured certain knowledge as to what earnings are to be under the reduced, or $1.25 per 1,000 schedule. Citizens gas is stronger, but the other shares are weak and halting. The *Eagle* some days ago, in its financial column, printed a statement reflecting on the credit of the Equity Gas Company that one would think the owners of the Company ought to speedily deny. We note a sale at auction of 60 shares Fulton-Municipal, at 113¼. Chicago gas shared the fluctuations of the excited market of the past 10 days. It opened to day at 51½ to ¾.

Gas Stocks.

Quotations by Geo. W. Close, Broker and Dealer in Gas Stocks.

16 Wall St., New York City.

September 28.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share.

	Capital.	Par.	Bid	Asked
Consolidated	$35,430,000	100	98½	99½
Central	500,000	50	—	90
" Scrip	220,000	—	95	100
Equitable	4,000,000	100	119	121
" Bonds	1,000,000	—	106	108
Harlem, Bonds	170,000	—	—	—
Metropolitan, Bonds	658,000	—	110	115
Mutual	3,500,000	100	119	121
" Bonds	1,500,000	—	100	102
Municipal, Bonds	750,000		—	—
Northern		50	—	—
" Bonds	150,000	—	—	100
Standard Gas Co—				
Common Stock	5,000,000	100	—	48
Preferred	5,000,000	100	—	90
Yonkers		50	112	—
Richmond Co., S. I.	346,000	50	—	—
" Bonds	20,000	—	—	—
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	95	98
Citizens	1,200,000	20	80	—
" S. F. Bonds	320,000	1000	100	103
Fulton Municipal	3,000,000	100	113	115
" Bonds	300,000		100	105
Peoples	1,000,000	10	60	63
" Bonds (7's)	368,000	—	100	—
" " (6's)	94,000	—	100	—
Metropolitan	870,000	100	90	92
" Bonds (5's)	70,000	—	—	—
Nassau	1,000,000	25	125	130
" Ctfs	700,000	1000	98	100
Williamsburgh	1,000,000	50	100	105
" Bonds	1,000,000	—	105	109

Advertisers Index.

GAS ENGINEERS. Page

Jos. R. Thomas, New York City ... 457
Wm. Henry White, New York City ... 463
Fred. Bredel, New York City ... 459
Jas. R. Smedberg, Peoria, Ills ... 457

CHEMISTS.

Durand Woodman, New York City ... 457

GAS AND WATER PIPES.

Mellert Foundry and Machine Co., Reading, Pa. (John Fox, Selling Agent, N. Y.) ... 457
Ohio Pipe Co., Columbus, Ohio ... 457
M. J. Drummond, New York City ... 457
R. D. Wood & Co., Phila., Pa ... 462
Warren Foundry & Machine Co., New York City ... 457
Donaldson Iron Co., Emaus, Pa ... 457
Addyston Pipe and Steel Co., Cincinnati, O ... 457

PROCESSES.

National Gas Light and Fuel Co., Chicago, Ills ... 454
Bartlett, Hayward & Co., Baltimore, Md ... 461
United Gas Improvement Co., Phila, Pa ... 453
Burdett Loomis, Hartford, Conn ... 450

GAS WORKS APPARATUS AND CONSTRUCTION.

James R. Floyd & Sons, New York City ... 463
Continental Iron Works, Brooklyn, N. Y ... 448
Deily & Fowler, Phila., Pa ... 463
Kerr Murray Mfg. Co., Fort Wayne, Ind ... 460
Stacey Mfg. Co., Cincinnati, Ohio ... 463
Bartlett, Hayward & Co., Baltimore, Md ... 461
Morris, Tasker & Co., Limited, Phila., Pa ... 461
Davis & Farnum Mf'g. Co., Waltham, Mass ... 460
R. D. Wood & Co., Phila., Pa ... 462
Bouton Foundry Co., Chicago, Ills ... 463
Isbell-Porter Company, New York City ... 462
Fred. Bredel, New York City ... 459
United Gas Improvement Co., Phila., Pa ... 453
National Gas Light and Fuel Co., Chicago, Ills ... 454
Berlin Iron Bridge Company, East Berlin, Conn ... 450

INCLINED RETORTS.

Laclede Fire Brick Mfg. Co., St. Louis, Mo ... 447
Parker-Russell Mining and Mfg. Co., St. Louis, Mo ... 458

GASHOLDER TANKS.

W. C. Whyte, New York City ... 454
J. P. Whittier, Brooklyn, N. Y ... 455

GASHOLDER PAINT.

The Government Waterproof Paint Co., Boston, Mass ... 450

RETORTS AND FIREBRICK.

J. H. Gautier & Co., Jersey City, N. J ... 458
B. Kreischer & Sons, New York City ... 458
Adam Weber, New York City ... 458
Laclede Fire Brick Mfg. Co., St. Louis, Mo ... 458
Brooklyn Retort and Fire Brick Works, Brooklyn, N. Y ... 458
Borgner & O'Brien, Phila., Pa ... 458
James Gardner, Jr., Pittsburgh, Pa ... 458
Henry Maurer & Son, New York City ... 458
Baltimore Retort and Fire Brick Co., Baltimore, Md ... 458
Parker-Russell Mining and Mfg. Co., St. Louis, Mo ... 458
Boston Fire Brick Works, Boston, Mass ... 458

CEMENTS.

C. L. Gerould & Co., Brooklyn, N. Y ... 458

SCRUBBERS AND CONDENSERS.

G. Shepard Page, New York City ... 416
R. D. Wood & Co., Phila., Pa ... 462
James R. Floyd & Sons, New York City ... 456
Continental Iron Works, Brooklyn, N. Y ... 448

REGENERATIVE FURNACES.

Bartlett, Hayward & Co., Baltimore, Md ... 461
Fred. Bredel, New York City ... 459
J. H. Gautier & Co., Jersey City, N. J ... 453
Parker-Russell Mining and Mfg. Co., St. Louis, Mo ... 458

GAS GOVERNORS.

Connelly Iron Sponge and Governor Co., New York City ... 455
Fred. Bredel, N. Y. City ... 459
Wilbraham Bros., Phila., Pa ... 455

SELF-SEALING MOUTHPIECE DOORS.

Isbell-Porter Company, New York City ... 462
Continental Iron Works, Brooklyn, N. Y ... 448

TAR AND CARBONIC ACID EXTRACTOR.

Geo. Shepard Page, N. Y. City ... 452

AMMONIA CONCENTRATOR.

Michigan Ammonia Works, Detroit, Mich ... 447

GAS METERS.

John J. Griffin & Co., Phila., Pa ... 466
American Meter Co., New York and Philadelphia ... 467
The Goodwin Gas Stove and Meter Co., Philadelphia, Pa ... 468
Helme & McIlhenny, Phila., Pa ... 467
D. McDonald & Co., Albany, N. Y ... 467
Nathaniel Tufts, Boston, Mass ... 466
Maryland Meter and Manufacturing Co., Baltimore, Md ... 465
Harris Bros. & Co., Philadelphia, Pa ... 466
Keystone Meter Co., Royersford, Pa ... 467

METER DIALS.

Caesar Bros., New York City ... 464

EXHAUSTERS.

The P. H. & F. M. Roots Co., Connersville, Ind ... 452
Isbell-Porter Company, New York City ... 462
Wilbraham Bros., Philadelphia, Pa ... 455
Connelly Iron Sponge and Governor Co., New York City ... 455

STEAM BLOWER FOR BURNING BREEZE.

H. E. Parson, New York City ... 413

GAS COALS.

Penn Gas Coal Co., Phila., Pa ... 463
Perkins & Co., New York City ... 464
Despard Coal Coal, Baltimore, Md ... 465
Chesapeake and Ohio R. R. Coal Agency, N. Y. City ... 465
Westmoreland Coal Company, Phila., Pa ... 465
J. & W. Wood, New York City ... 464

CANNEL COALS.

Perkins & Co., New York City ... 464
J. & W. Wood, New York City ... 464

ANTHRACITE COALS.

Coxe Bros. & Co., New York City ... 465

GAS ENRICHERS.

Standard Oil Co., Cleveland, Ohio ... 440

BARROWS.

Grant McNeil, Akron, O ... 447

COKE CRUSHER.

C. M. Keller, Columbus, Ind ... 465

VALVES.

Ludlow Valve Manufacturing Co., Troy, N. Y ... 440
Chapman Valve Manufacturing Co., Boston, Mass ... 439
R. D. Wood & Co., Phila., Pa ... 462
The P. H. & F. M. Roots Co., Connersville, Ind ... 452
Continental Iron Works, Brooklyn, N. Y ... 448

GAS ENGINES.

Schleicher, Schumm & Co., Phila., Pa ... 432
Clerk Gas Engine Co., Phila., Pa ... 465

ENGINES AND BOILERS.

Jarvis Engineering Co., Boston, Mass ... 455
Westinghouse Machine Co., Pittsburgh, Pa ... 457

GAS LAMPS.

Fiske, Coleman & Company, Boston, Mass ... 448

PURIFIER SCREENS.

John Cabot, New York City ... 446

GAS STOVES.

American Meter Co., New York and Philadelphia ... 451
The Goodwin Gas Stove and Meter Co., Phila., Pa ... 468
George M. Clark & Co., Chicago, Ills ... 449
Maryland Meter and Manufacturing Co., Baltimore, Md ... 466
Dangler Stove and Mfg. Co., Cleveland, O ... 448

BURNERS.

C. A. Gefrorer, Phila., Pa ... 447
Moses G. Wilder, Phila., Pa ... 447
H. W. Rappleye, Phila., Pa ... 449

STREET LAMPS.

J. G. Miner, Morrisania New York City ... 459
Bartlett Street Lamp Mfg. Co., New York City ... 459

PURIFYING MATERIAL.

Connelly Iron Sponge and Governor Co., New York City ... 455
Greenpoint Chemical Works, Brooklyn, N. Y ... 455

ELECTRICAL APPARATUS.

Wm. Henry White, N. Y. City ... 463
Fort Wayne Electric Co., Fort Wayne, Ind ... 456
Weston Electrical Instrument Co., Newark, N. J ... 447

Position Wanted

As Superintendent of Gas Works or Construction Co.

By a man of experience in the construction of gas works, and also in manufacture and distribution of gas. Best of references given. Address

849-4 "W. S.," care this Journal.

POSITION WANTED

AS SUPERINTENDENT OF SMALL GAS WORKS

By a young man fully experienced in the details of construction, manufacture and distribution; also in fitting, main laying, etc. Best of references. Address

850-2 "A. W.," care this Journal.

For Sale.

Ten-Horse Power Otto Gas Engine,

In the best condition. Address

850-2 J. H. BAUMGARDNER, Lancaster, Pa.

FOR SALE.

75 Per Cent. of the Stock of a Gas and Electric Company,

In a growing town 45 minutes from New York. Company has a contract for street lighting for 5 years by gas and electricity. Both plants in excellent order. Owner of stock wishes to retire on account of age. For particulars apply to

10-3 "U. T. S.," care this Journal.

To Gas Companies.

We make to order **CAP BURNERS** to burn any amount under a stated pressure. Send for samples.

Also, SERVICE CLEANERS, DRIP PUMPS, and STREET MAIN PROVING APPARATUS.

C. A. GEFRORER,

218 N. 8th St., Phila., Pa.

Utilize Your Gas Liquor.

NO EXTRA LABOR OR OPERATING EXPENSES.

Ammonia Concentrator,

Not Expensive. Write to

STROH & OSIUS, Pat'ees, or

Mich. Ammonia Works, Detroit, Mich.

Special Trays for Iron Sponge or Oxide of Iron.

CHURCH'S TRAYS a Specialty.

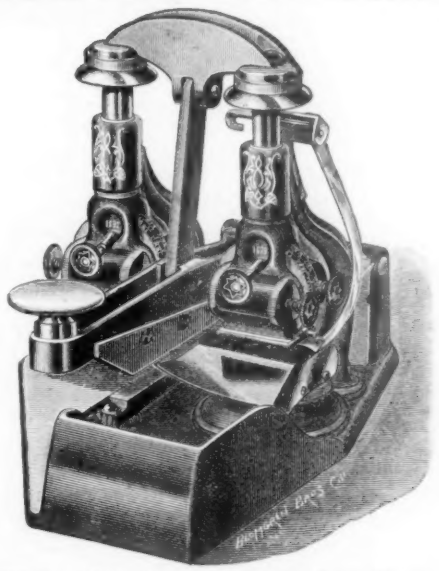
Reversible, Strongest, Most Durable, Most Easily Repaired.

306-310 Eleventh Avenue, New York.

We also make the Cheapest and Strongest REVERSIBLE BOLTED TRAYS IN THE MARKET.

Send for Circulars.

COUPON CUTTER.



Will Receipt, Cut Off and Deliver Coupon

Gas Bills

Five times as fast as by any other method. With it a Bill cannot be receipted and passed out without detaching and retaining the Coupon.

MR. GEO. A. YUILLE, Sec. Chicago Gas Light and Coke Co., says: "Its use has saved us, in 'Receiver's' salaries alone, thousands of dollars."

MR. HORACE W. BECK, Sec. Fort Worth Light and Power Co., says: "The machine works splendidly; we are charmed with it, and can do the work with it in one-half the time."

MR. J. D. THOMPSON, Vice-Prest. Laclede Gas Light Co., St. Louis, says: "We can handle three or four persons where only one could be attended to before."

Send for Circular.

FELT & TARRANT MFG. CO.,

52 Illinois St., Chicago.

MOSES G. WILDER, MECH. ENGR.

316-18-20-22 Cherry St., Phila., Pa.

Volumetric Lamp Governors

FOR GAS LAMPS & HIGH-POWER BURNERS.

GOVERNOR BURNERS

for

STREET LAMPS AND GENERAL USE,

and

GOVERNORS FOR ARGAND AND OTHER COMMON GAS BURNERS IN ALL SIZES.

HORIZONTAL

Governors

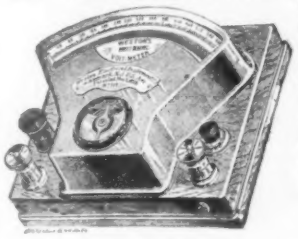
Specially adapted for GAS STOVES, FURNACES, Etc., Etc.

It is well known that a large majority of all High Power Gas Lamps in the United States have my Governors attached, and they are always used by the leading makers of these lamps. To remove any excuse for the use by anyone of inferior and infringing Governors, a reduction in price has been made, and all exclusive contracts are cancelled.

Correspondence Solicited with all who require a Reliable Governor.

The Weston Standard

VOLTMETERS AND AMMETERS.



These Instruments are the most accurate, reliable, and sensitive portable instruments ever offered. A large variety of ranges, to meet the requirements of all kinds of work.

Send for Catalogue.

Weston Electrical Instrument Co.,

Office & Factory, 114-116 William St, Newark, N. J.

The Nineteenth Annual Meeting of the American Gas Light Association

Will be Held at New York, Oct. 21, 22 and 23.

HEADQUARTERS AT THE HOLLAND HOUSE, Fifth Ave. & 30th St.

Each application for membership (Active or Associate), or for transfer from Associate to Active, must be completed and in the hands of Acting Secretary at least ten days before meeting. Each application must be endorsed by two Active Members of Association to be complete.

No payment for initiation fee required in advance.

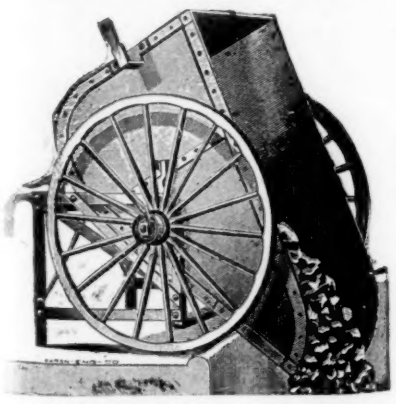
"To be *eligible* as an *Active Member* a person must be a president, secretary, treasurer, engineer, consulting engineer, or superintendent of a gas company, or a manager of a gas works."

"*Associates* shall be persons holding a responsible position in a gas works, or persons whose pursuits constitute branches of gas engineering, or who are otherwise qualified to assist in promoting the objects of the Association."

Application blanks may be obtained of the Acting Secretary,

ALEX. C. HUMPHREYS, Drexel Building, Phila., Pa.

McNeil's Balanced Charging Barrow.



For Coal or Coke. Best for charging or drawing hot Coke. Dumps on the floor. Can carry 1,500 pounds with one man power.

STEEL WHEELBARROWS.

Best Barrows Ever Made.

Send for Catalogue.

GRANT McNEIL,

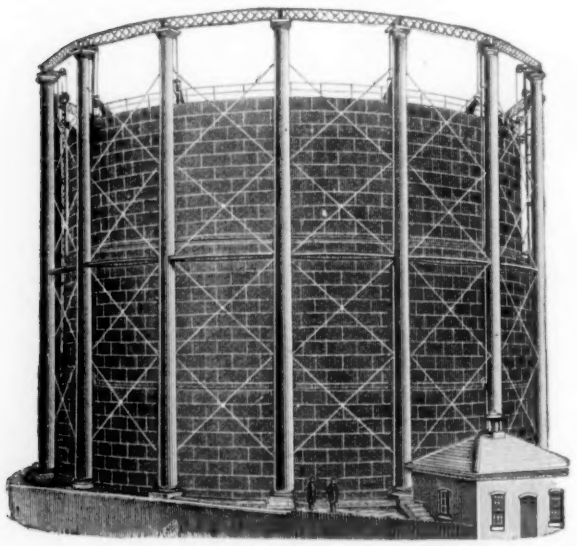
225 N. Union Street,

AKRON, OHIO.

The Continental Iron Works

THOS. F. ROWLAND, President. THOS. F. ROWLAND, Jr., Secretary & Treasurer. WARREN E. HILL and CHAS. H. CORBETT, Vice-Presidents.

Take 10th or 23d Street Ferries from New York to Greenpoint. **BROOKLYN, N. Y.**



BUILDERS OF

GAS HOLDERS,

SINGLE-LIFT and MULTIPLE-SECTION GAS HOLDERS A SPECIALTY.

Wrought Iron Gas Holder Tanks.

BENCH CASTINGS, RETORT LIDS,

Hydraulic Mains, Condensers, Scrubbers,

PURIFIERS, VALVES, Etc.

SELF-SEALING
Retort Mouthpieces and Lids.

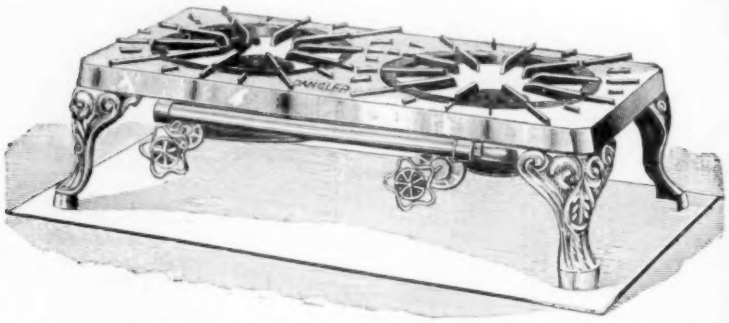
For Round, Oval, or "D" Retorts.

THE DANGLER GAS RANGES AND STOVES.

In calling the attention of those interested to our perfect working GAS STOVES AND RANGES, after a thorough and rigid trial of years, we have the unqualified assurance from the heads of over 6,000 households that our GAS RANGES AND STOVES are a perfect success for baking, cooking, broiling and roasting, and our

HOT WATER DEVICE

is a marvel of convenience and economy, furnishing an unfailing supply of hot water.



Our line includes all the different styles of Ranges and Stoves, and we call special attention to our

Hot Plates,

which are especially popular on account of the size and style, and finished either in nickel or polished iron.

We invite correspondence and send Catalogues on application.

New York Show Rooms, 40 & 42 College Place. **THE DANGLER STOVE AND MFG. CO., Cleveland, O.** THOS. HOLT, 111 & 113 N. 2d St., Phila.

Standard Oil Company,

GAS NAPTHA DEPARTMENT OF THE WEST.

GAS NAPTHA.

GAS OIL.

Correspondence Solicited.

CLEVELAND, OHIO.

CHAPMAN VALVE MANUFACTURING CO.,

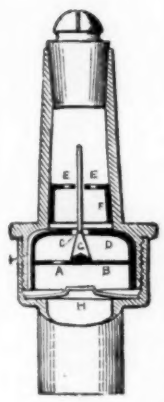
MANUFACTURERS OF

Valves and Gates for Gas, Ammonia, Water, Etc.

Also, Gate Fire Hydrants With and Without Independent Nozzle Valve. All Work Guaranteed.

WORKS & GEN'L OFFICE: Indian Orchard, Mass.

TREASURER'S OFFICE: 72 Kilby & 112 Milk Sts, Boston, Mass.



Rappleye's Rheometric Governor Burner.

Free Sample and Special Price to Gas Light Companies.

OFFICE OF PHILADELPHIA GAS WORKS, PHILADELPHIA, Dec. 11, 1889.

Rappleye's Rheometric Governor Burners have been in use on all of the Street Lamps of the Philadelphia Gas Works for the last seven years. After a two years' test they were adopted by the Board of Trustees as their standard, and at that time were placed on all fixtures of all Police Stations, Fire Department Stations, Court Houses, Almshouse, New City Hall—in fact, on all fixtures of all public buildings throughout the city. With a better light than ever before, the reduction in gas consumption by their use is fully 35 per cent. The accuracy of their adjustment, the increased luminosity of gas secured, and especially their freedom from impairment by use, constrain me to pronounce them **The Best Governor Burner Made.** I recommend them to all Gas Light Companies, not only for Public Lamps, but also for consumers' use, as giving better results for gas consumed than can be otherwise attained. W. K. PARK.

H. W. RAPPLEYE, 2814 Poplar St., Phila., Pa.

LUDLOW VALVE MFG. CO.

OFFICE AND WORKS,
938 to 954 River Street and 67 to 83 Vail Av.,
TROY, N. Y.

Hydraulic Main Trip Regulators, also **Check Valves, Foot Valves, Yard-wash and Fire Hydrants.**

Send for Circulars.

Valves.—Double and Single Gate, ¾ in. to 48 in., outside and inside Screws. Indicator, etc., for Gas, Water, Steam, and Oil.

Send for Circulars.

JEWEL GAS STOVES

MANUFACTURED BY

GEORGE M. CLARK & COMPANY,

157 & 159 Superior Street, - Chicago, Ill.

EVERY CONCEIVABLE SIZE AND STYLE.

Ranging in Prices from $1.50 to $37.00.

WE USE NO GAS COCKS.

All Flames are Regulated by a Direct Needle Valve.

The JEWEL

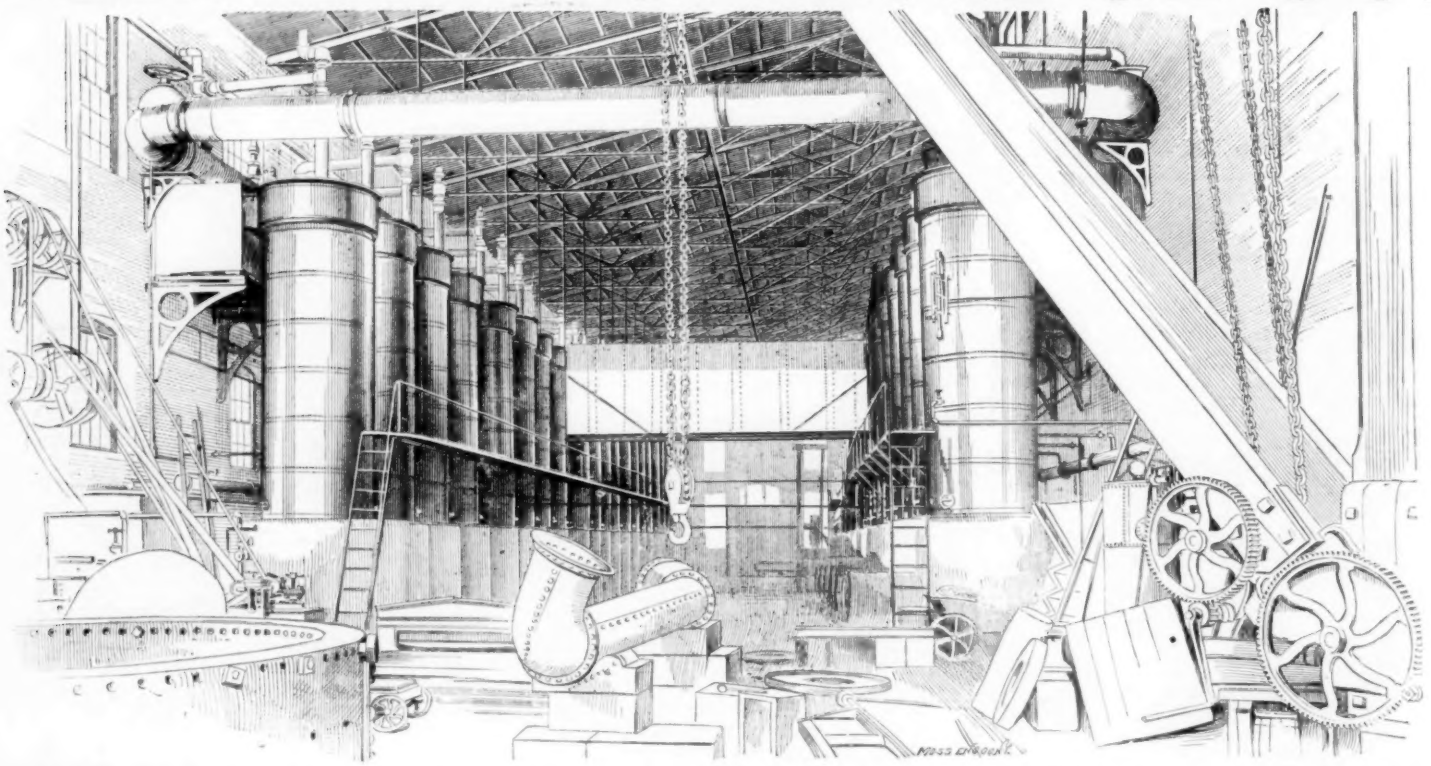
IS THE

Only Well-Made Gas Stove on the Market.

Write for our 1890 Catalogue and see for yourself.

Jewel Circulating Water Heater. $15.00.

THE BERLIN IRON BRIDGE CO.



The above illustration is taken from a photograph, and shows the interior of a boiler room, the roof of which was designed and built by us for the Amoskeag Mfg. Co., at Manchester, N. H. The roof is composed entirely of iron—iron trusses, iron purlins, covered with corrugated iron—so that the danger from fire is entirely eliminated. *Write for Illustrated Catalogue.*

Office and Works, EAST BERLIN, CONN.

AGENCIES.—S. W. BOWLES, JR., Western Mangr., 556 Rookery Building, Chicago, Ill. W. E. STEARNS, 318 Odd Fellows Building, St. Louis, Mo.

GASHOLDER PAINT.

Use Only

THE GOVERNMENT WATERPROOF PAINT.

Proof against Ammonia, and Absolutely Waterproof. Send for Prices and Particulars.

THE GOVERNMENT WATERPROOF PAINT CO., 122 Milk Street. Boston. Mass

Fuel and Its Applications

By E. J. MILLS, D.Sc. F.R.S., and F. J. ROWAN, C.E., assisted by others, including Mr. F. P. Dewey, of the Smithsonian Inst., Wash., D. C.

7 PLATES, AND 607 OTHER ILLUSTRATIONS. ROYAL OCTAVO, PAGES XX, 802. HANDSOME CLOTH, **$7.50.**

A. M. CALLENDER & CO., 32 Pine St., N. Y.

Water Gas! Fuel Gas!

For all Manufacturing Purposes. Generated from Bituminous Slack, Anthracite Coal Dust, or Coke Breeze, by

THE LOOMIS PROCESS.

Now in successful operation at Works of John Russell Cutlery Co., Turner's Falls, Mass., and Henry Disston's Sons' Saw Works, Tacony, Pa.

The Cheapest Gas Generating System in the World.

Utilizing any Kind of Low-Priced Coals.

NOVEL IN DESIGN, MODERN IN CONSTRUCTION, SIMPLE IN OPERATION, PERFECT IN RESULTS.

Plans and Estimates Furnished.

BURDETT LOOMIS, - - Hartford, Conn.,

Or Murray Hill Hotel. New York City.

King's Treatise on Coal Gas.

In Three Volumes. Price per Vol., $10. Sold either by Volume or in Sets.

A Standard text-book for the Engineers and Managers of Gas Works, and for all who are concerned or take an interest in the manufacture and distribution of Coal Gas, and in the utilization of the Secondary Products resulting therefrom; treating also of the Gas Engine, and of Gas Cooking and Heating Appliances. A. M. CALLENDER & CO., 32 Pine Street, N. Y. City.

GAS STOVES. GAS METERS. GAS STOVES.

THE AMERICAN METER CO.

Established 1834. Incorporated 1863.

MANUFACTURERS OF

Standard 3 Diaphragm Dry Meter.

Gas Meters,

STATION METERS,

METER PROVERS, PHOTOMETERS,

Experimental Meters of all Kinds,

AND

Standard 2 Diaphragm Dry Meter.

Apparatus for Testing the Quantity and Quality of Gases.

Meters for Measuring Natural Gas.

MANUFACTORIES,

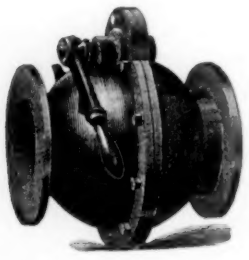
508 to 514 West Twenty-second St., N. Y. Arch and Twenty-second St., Phila.
Nos. 244 & 246 North Wells Street, Chicago, Ill.

AGENCIES,

No. 177 Elm Street, Cincinnati, Ohio. No. 222 Sutter Street, San Francisco, Cal.
No. 810 North Second Street, St. Louis, Mo.

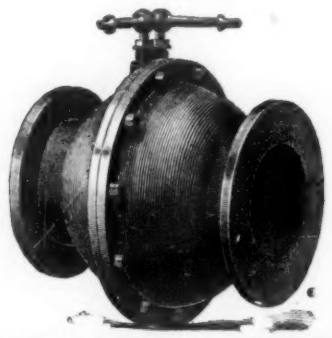
GAS STOVE SHOW ROOMS, No. 242 Sixth Avenue, New York City.

ROOTS'
GAS AND BYE-PASS VALVES.



GAS VALVE

Quick Acting,
Simple,
Efficient Durable.



BYE-PASS VALVE.

Automatic Action
Reliable
Simple Durable.

Thousands now in use and giving perfect satisfaction. Write for Catalogue and Prices.

Send for Descriptive Catalogue and Price List.

THE P. H. & F. M. ROOTS CO., Patentees and Manufacturers, **CONNERSVILLE, IND.**

S. S. TOWNSEND, Gen. Agts., COOKE & CO., Selling Agts., 163 & 165 Washington St., N. Y.

THE WALKER TAR AND CARBONIC ACID EXTRACTOR.

A very general demand exists, in both large and small Gas Works, for an apparatus that will be absolutely efficient in the removal of the Tar which passes the hydraulic main and condenser. Many attempts have been made to accomplish this, but, I believe, without success, until the introduction, six years ago, in England, of the C. & W. Walker Patent Tar and Carbonic Acid Extractor. During these years this apparatus has been adopted by many of the most prominent Engineers, not only in England, but also on the Continent of Europe and in other parts of the world. Several have been erected in the United States.

"The C. & W. Walker Tar and Carbonic Acid Extractor has been in operation at these works for the past six weeks, and is an unqualified success. It removes every particle of Tar from the gas in once passing through the apparatus, and a large percentage of the Carbonic Acid. I also feel quite sure that it prevents the formation and deposit of Naphthaline, because since I started the Washer I have had no stoppages from this cause. These works have been seriously troubled with Tar for many years, and I have used several kinds of apparatus and every expedient which has come to my attention for dealing with the difficulty, but without success. The Walker apparatus occupies comparatively small space, is less expensive than other systems, and requires but little attention. I carry 2½-inch seal, and have an automatic tar delivery valve. This Tar Extractor is indispensable to gas makers.

"C. A. GERDENIER, Supt. Bridgeport (Conn.) Gas Lt. Co."

This Tar Extractor will perform its work with about one-fourth the usual back-pressure heretofore required. It is simple in construction, and can be supplied at a very reasonable price—less than any other ever before introduced. Satisfactory results guaranteed in every instance.

GEO. SHEPARD PAGE, Sole Agt. for the U. S., 69 Wall Street, N. Y. City.

SCIENTIFIC BOOKS.

KING'S TREATISE ON THE MANUFACTURE OF COAL GAS. Three vols.; $10 per vol.

GAS MANUFACTURE, by WILLIAM RICHARDS. 4to., with numerous Engravings and Plates, in Cloth binding. $12.

TECHNICAL GAS ANALYSIS. $2.80.

GAS CONSUMER'S GUIDE. $1.

GAS MEASUREMENT AND GAS METER TESTING, by F. W. HARTLEY. $1.60

GAS CONSUMER'S HANDBOOK, by WILLIAM RICHARDS, C.E.; 18mo., Sewed. 20 cents.

A PRACTICAL TREATISE ON GAS AND VENTILATION with Special Relation to Illuminating, Heating, and Cooking by Gas, by E. E. PERKINS. $1.25.

CHEMISTRY OF ILLUMINATING GAS, by NORTON H. HUMPHRYS. $2.40.

PRACTICAL TREATISE ON HEAT, by THOMAS BOX. Second edition. $5.

STRAINS IN IRONWORK, by H. ADAMS. With plates. $1.75.

GAS WORKS—THEIR ARRANGEMENT, CONSTRUCTION, PLANT, AND MACHINERY. $8.

COAL: ITS HISTORY AND USE, by PROF. THORPE. $3.50.

THE GAS WORKS OF LONDON, by COLBURN. 60 cents.

HEAT A MODE OF MOTION, by JOHN TYNDALL. $2.50.

MUNICIPAL LIGHTING, by F. H. WHIPPLE. $1.

GAS WORKS, AND MANUFACTURING COAL GAS, HUGHES. $2.20.

THE MANAGEMENT OF SMALL GAS WORKS, by C. J. R. HUMPHREYS. $1.

MANUAL FOR GAS ENGINEERING STUDENTS, by D. LEE, 40 cents.

THEORY OF HEAT, by J. CLERK-MAXWELL. $1.25.

THE DOMESTIC USES OF COAL GAS, AS APPLIED TO LIGHTING, by W. SUGG. $1.40.

DIGEST OF GAS LAW. $5.

DISTLLATION OF COAL TAR AND AMMONIACAL LIQUOR, by GEO. LUNGE. New Edition. $12.50.

A TREATISE ON THE COMPARATIVE COMMERCIAL VALUES OF GAS COALS AND CANNELS, by D. A. GRAHAM 8vo., Cloth. $3.

GAS COMPANIES DIRECTORY, 1891. $5.

THE AMERICAN GAS ENGINEER AND SUPERINTENDENT'S HANDBOOK, by WM. MOONEY. $3.

GAS ENGINE INDICATOR DIAGRAM, by W. E. AYRTON. Paper. 20 cents.

ILLUMINATING AND HEATING GAS, by W. BURNS. $1.50.

TESTING PIPES AND PIPE JOINTS, by M. M. PATERSON. 80 cents.

DESIGNING WROUGHT AND CAST IRON WORK, by H. ADAMS. Paper. Three parts, 60 cents each.

NOTES IN MECHANICAL ENGINEERING, by H. ADAMS. $1

The above will be forwarded by express, upon receipt of price. If sent by mail, postage must be added to above prices. We take especial pains in securing and forwarding any other Works that may be desired, upon receipt of order. All remittances should be made by check, draft, or post office money order.

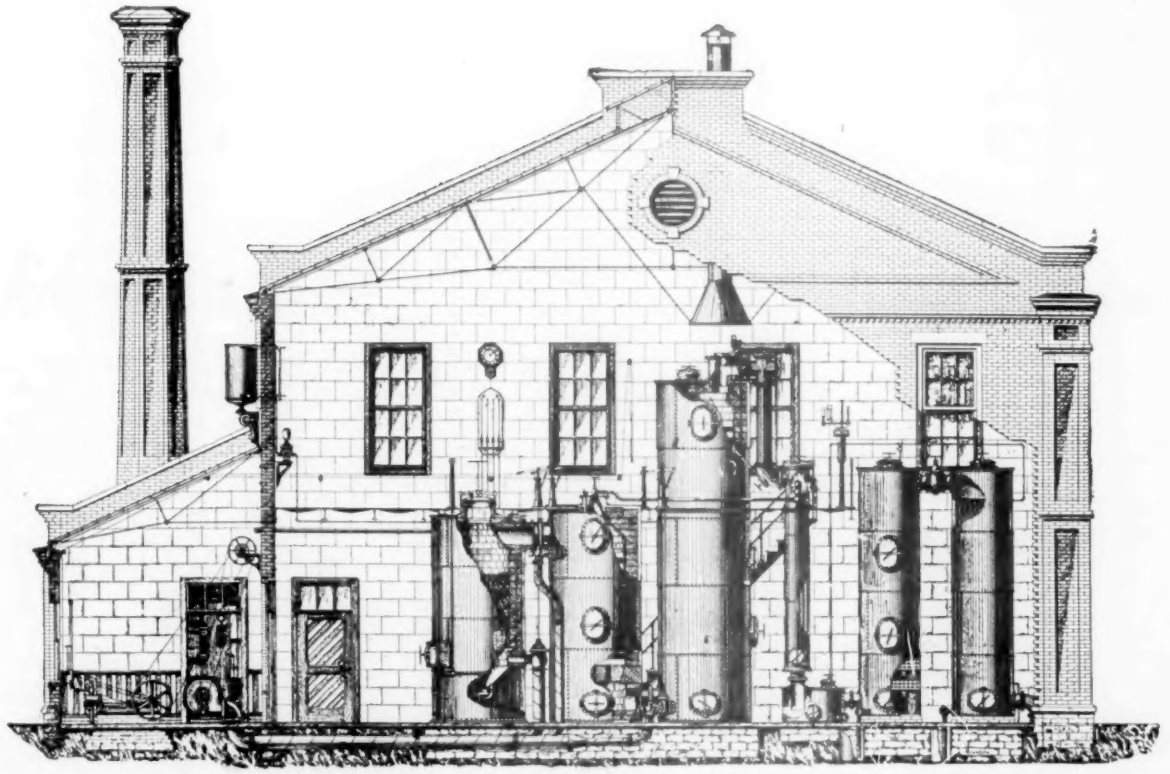
A. M. CALLENDER & CO., 32 Pine Street, New York.

THE UNITED
GAS IMPROVEMENT CO.,

DREXEL BUILDING, PHILA., PA.

Owners of the Lowe, Granger-Collins, McKay-Critchlow (for carbureting Natural Gas), and Other Gas Patents.

BUILDERS, LESSEES and PURCHASERS OF GAS WORKS.



Standard "Double Superheater" Lowe Apparatus, Especially Designed for the Use of Lima Crude Oil.

Erectors of

WATER GAS PLANTS,

(Either Independent or Auxiliary to Coal Gas Works),

USING LIMA OR OTHER LOW GRADE OILS AND ANTHRACITE COAL OR GAS HOUSE OR OVEN COKE

PAMPHLETS, PLANS, AND ESTIMATES FURNISHED UPON APPLICATION.

NATIONAL
GAS LIGHT AND FUEL CO.,

No. 52 Lake Street, Chicago.

FRED'K H. SHELTON, Manager.

GAS WORKS

Built, Remodeled, Leased, or Purchased.

THE SPRINCER CUPOLA SYSTEM.

Also, by Special Arrangement with the United Gas Improvement Company,

AGENTS FOR THE WEST

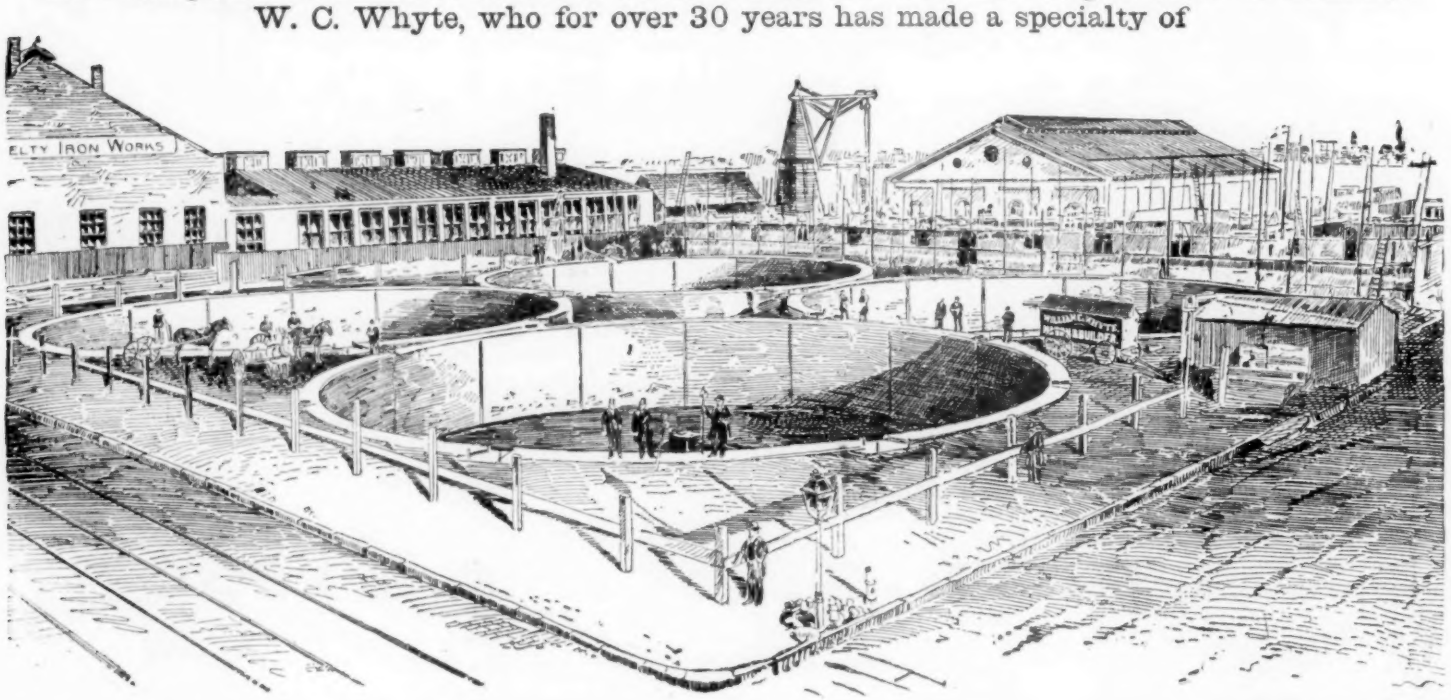
FOR THE "DOUBLE-SUPERHEATER," "JUNIOR," AND OTHER FORMS OF THE

Lowe Water Gas Apparatus.

Full Information Furnished upon Application.

GASHOLDER TANK CONSTRUCTION, ETC.

Gas Companies and others about to erect Gasholders will find it profitable to consult W. C. Whyte, who for over 30 years has made a specialty of



Tank Excavation and Mason Work.

Fifty Tanks now in operation show the sort of work done. Address

W. C. WHYTE, - No. 15 Cortlandt Street, N. Y. City.

WHAT OUR CUSTOMERS SAY OF IRON SPONGE.

COLUMBUS, O. I regard the Connelly Iron Sponge as the best form of oxide of iron of which I have any knowledge.
E. McMillin, Eng'r.

OHIO PENITENTIARY, I take pleasure in saying that the Iron Sponge bought of you two years ago, and which has been in constant use ever since, has given entire satisfaction. It does all you claim for it; in fact it reduces the cost of purifying to almost nothing—which certainly ought to be satisfactory. R. P. Green, Supt.

CINCINNATI, O. Our experience shows that by the use of Iron Sponge in place of lime we have effected a saving of 1.4 cents per M. in cost of purification. A. Hickenlooper, Prest.

SANDUSKY, O. The Iron Sponge has been a great advantage and saving to us over old method. Thos Wood, Supt.

CADIZ, O. We have been using your Sponge for five years with entire satisfaction, and at about one-fourth the cost when we used lime for purification. A. N. Hammond, Supt.

LOGAN O. We have no desire to go back to purification by lime.
A. Michie, Sec.

LIMA, O. We have used your Iron Sponge for two years, nothing else, and are entirely satisfied with it. Lima Gas Lt. Co.

TROY, O. Recommend Iron Sponge to any Gas Company. It is as good and far cheaper than lime, and far less labor connected with it. R. A. Dittmar, Supt.

WOOSTER, O. We have used your Iron Sponge about 8 months with entire satisfaction, and we shall continue to use it as long as we can do so with the success we have had thus far.
Wooster Gas Lt. Co.

HAMILTON, O. We have been using your Iron Sponge for the past 5 years exclusively—using no lime with it—and it affords us pleasure to testify to its merits. Our present lot has been in use now over 16 months. D. H. Hensley, Sec.

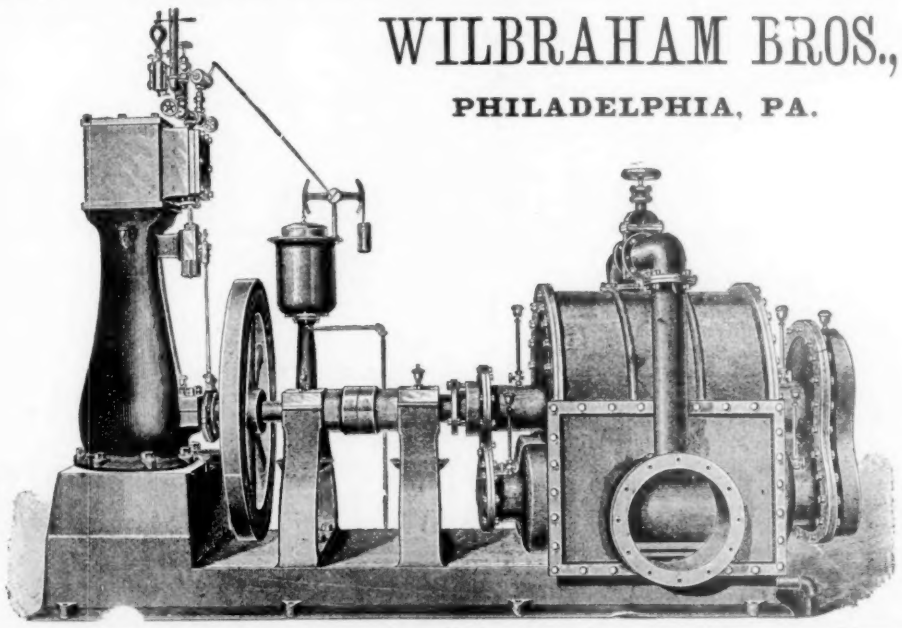
MANSFIELD, O. Our Company has been using your Iron Sponge for 2 years in our works for purifying. It has been very satisfactory, and we would not know how to get along without its use.
G. S. Harris, Supt.

PORTSMOUTH, O. We have been using your Iron Sponge, and so far *it has given entire satisfaction.* J. W. Smith, Sec.

PAINESVILLE, O. We have used your Iron Sponge for the past 2 years, and shall continue to use it. *It gives perfect satisfaction.* J. W. Alexander, Prest.

CONNELLY IRON SPONGE AND GOVERNOR CO., No. 111 Broadway, New York.

WILBRAHAM
GAS EXHAUSTER & ENGINE COMBINED.



WILBRAHAM BROS.,
PHILADELPHIA, PA.

IRON MASS
For Gas Purification.

Acts immediately, and more efficiently than any other purifying agent now in use.

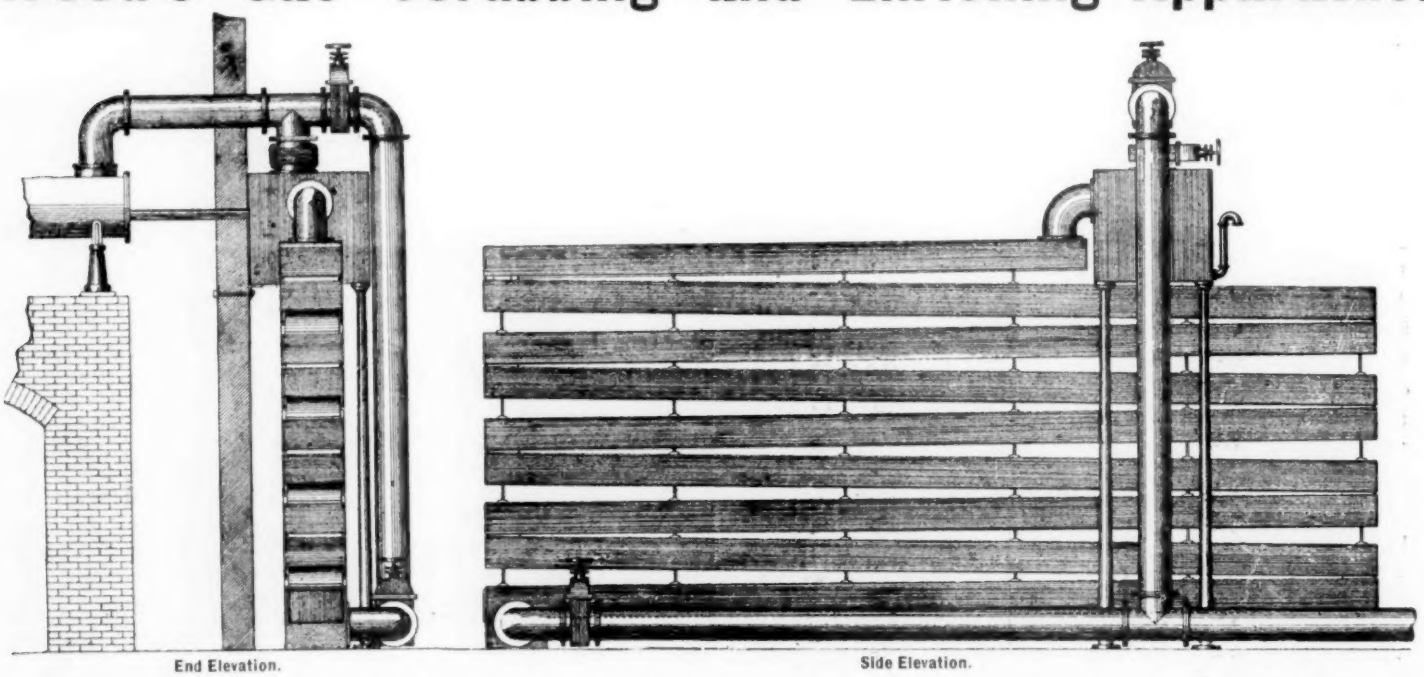
Greenpoint Chemical Works.
JOHN SCHRIEVER, Manager.
Greenpoint Ave. & Newtown Creek, Brooklyn N.Y.

JARVIS ENGINEERING CO.,
61 Oliver St., Boston, Mass.
CONTRACTORS FOR ERECTING
COMPLETE STEAM OUTFITS FOR ELECTRIC LIGHTING STATIONS.
Steel Boilers set with Jarvis Pat. Boiler Setting
To burn **COKE SCREENINGS** for Fuel.
ARMINGTON & SIMS CO. ENGINES,
Belting direct to Dynamos, without using Shafting.
SEND FOR CIRCULARS.
References.—Charlestown Gas & Electric Light Co., Charlestown, Mass.; Schenectady Gas & Electric Light Co., Schenectady N. Y.; Brookline Gas Co., Brookline, Mass.

Gasholder Tanks & Gas Works Masonry Complete.
PLANS PREPARED AND ESTIMATES FURNISHED AT SHORT NOTICE.
J. P. WHITTIER, 70 Rush St., near Division Av., Brooklyn, N. Y.
A Large Quantity of Ground Fire Brick For Sale Cheap.

1891 DIRECTORY 1891
OF AMERICAN GAS COMPANIES.
Price, - - - - - - - $5.00.
A. M. CALLENDER & CO., No. 32 Pine Street, New York City.

Wood's Gas Scrubbing and Enriching Apparatus.



End Elevation. Side Elevation.

The cheapest, simplest, and most effective apparatus for removing Tar and Ammonia, and enriching Gas, ever brought to the attention of Gas Manufacturers. With ordinary condensers and scrubbers the condensable illuminants flow off to the tar wells and liquor tanks and are lost, but with Wood's Apparatus these illuminants are saved and retained in the gas, thus increasing its illuminating power and making a great saving in the cost of enriching material. Where set up next after the Hydraulic main, this Scrubber produces an 8-oz. Ammoniacal Liquor.

JAMES R. FLOYD & SONS, - - Nos. 531 to 543 West 20th Street, N. Y. City.

FORT WAYNE ELECTRIC CO.

FORT WAYNE, IND.

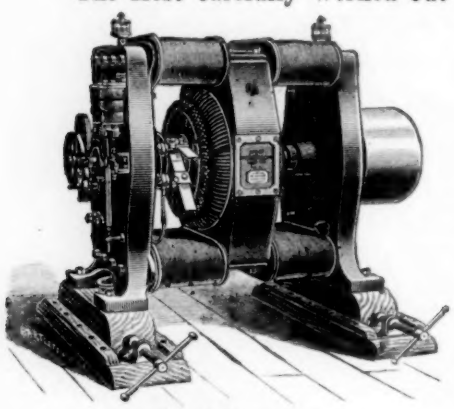
MANUFACTURERS OF THE

Slattery Induction System

—OF—

LONG DISTANCE INCANDESCENT LIGHTING.

The Most Carefully Worked Out and Complete Alternating Current System of Electric Lighting in Existence.



Wood Dynamo.

—AND THE—

WOOD

Automatically Regulating

ARC DYNAMOS AND LAMPS.

Main Office and Factory, Fort Wayne, Ind.

BRANCH OFFICES.

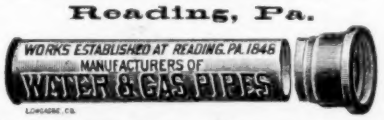
NEW YORK,	115 Broadway.	PITTSBURCH, PA.,	533 Wood Street.
PHILADELPHIA,	907 Filbert Street.	DALLAS, TEXAS,	McLeod Building.
CHICAGO,	185 Dearborn Street.	TORONTO, CANADA,	138 King Street, West.
SAN FRANCISCO,	35 New Montgomery Street.	MEXICO, F Adams' Successors,	City of Mexico.
BUFFALO N. Y.	228 Pearl Srteet.	CUBA, Maicas & CO.,	Havana.

ENGINEERS.

P. D. WANNER, Chairman. A. H. MELLERT, Mangr. of Wks.
R. B. KINSEY, Secretary. F. A. KNOPP, Treasurer.

MELLERT FOUNDRY & MACHINE CO. Ltd. and READING FOUNDRY CO., Ltd.

Reading, Pa.



Specials—Flange Pipe, Valves and Hydrants Lamp Posts, Retorts, etc.

General Foundry and Machine Work.

JOHN FOX, Selling Agent. **160 Broadway, N.Y.**

THE OHIO PIPE COMPANY,

MANUFACTURERS OF

Cast Iron Gas & Water Pipe,

BRANCH AND SPECIAL CASTINGS.

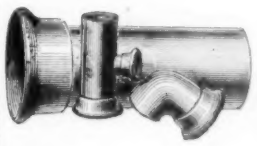
Gas-House Bench Castings, Hydraulics, Lamp Posts, Flange Pipe and Specials, Architectural Castings, Building Columns, Joists, Cellar Grates, Sash Weights, etc.

GENERAL FOUNDERS AND MACHINISTS.

Columbus, Ohio.

GAS AND WATER PIPES.

WARREN FOUNDRY AND MACHINE CO.,



Established 1856. Works at Phillipsburgh, N. J.

New York Office, 160 Broadway.

CAST IRON WATER AND GAS PIPE,

FROM THREE TO FORTY-EIGHT INCHES DIAMETER. ALSO, ALL SIZES OF

Flange Pipe for Sugar House and Mine Work. Branches, Bends, Retorts, etc., etc.

M. J. DRUMMOND,

SPECIAL CASTINGS AND LAMP POSTS.

Office, Corbin Building, 192 Broadway, N. Y.

EMAUS PIPE FOUNDRY.

DONALDSON IRON COMPANY. EMAUS, PA.

MANUFACTURERS OF

CAST IRON PIPE AND SPECIAL CASTINGS

FOR WATER AND GAS.

THE ADDYSTON PIPE AND STEEL COMPANY,

CAST IRON CINCINNATI, OHIO.

PIPE

FOR MANUFACTURED AND NATURAL GAS AND WATER.

SPECIALS, FLANGE PIPE, AND LAMP POSTS

JOS. R. THOMAS,

No. 32 Pine Street, N.Y. City.

CONSULTING AND CONSTRUCTING

Gas Engineer and Contractor.

PLANS, SPECIFICATIONS, AND ESTIMATES FURNISHED.

Contracts taken for all Appliances required at a Gas Works,

Either for New Works or Extensions to Old Plants.

JAMES R. SMEDBERG,

Gas Engineer,

213 Jefferson Ave., Peoria, Ill.,

Will furnish Plans, Specifications and Estimates for the Remodeling or extension of Gas Works. Also, Analytic Reports upon the business condition and prospects of Gas Companies. Ample references will be given.

DURAND WOODMAN, Ph.D.,

Analytic and Technical

CHEMIST.

Analyses of Gas, Fuel and Gas Coals, Crude and Refined Petroleum, Materials for Gas Purification, Tar, Ammoniacal Liquors and other Bye-Products, Fire Clays, Deposits in Mains, Water for Steam Making, Boiler Scale, etc, etc. Expert work in connection with "Damages to adjacent water supplies and adjoining properties." Experimental Investigations for Inventors.

127 Pearl Street (Hanover Square), N. Y.

WESTINGHOUSE ENGINES

A FEW PROMINENT MISCELLANEOUS USERS

(Excepting Governments and Railroads).

Adams Express Company; Allegheny City Light Plant; Allegheny County Light Company; Anheuser-Busch Brewing Company; Arbuckle Brothers; Ashcroft Manufacturing Company; E. Balbach & Son; Baldwin Locomotive Works; Bowers Dredging Company; Brooks Locomotive Works; Brown & Sharpe Manufacturing Company; Brush Electric Company of Baltimore; Brush Electric Light Company of Buffalo; Burlington Electric Street Railway Company; Calumet & Hecla Mining Company; Cambria Iron Company; Carnegie, Phipps & Company; Cincinnati Gas Light & Coke Company; Coxe Brothers & Company; Crescent Steel Works of Miller, Metcalf & Parkin; Cumberland & Presumpscot Mills, Denver Consolidated Electric Company; Detroit Dry Dock Company, Detroit Electric Light & Power Company; Dunnell Manufacturing Company; East End Electric Light Company of Pittsburgh; Elgin National Watch Company; Federal Street & Pleasant Valley Electric Street Railway Company of Pittsburgh and Allegheny; Forest Paper Company; Gate City Oil Mills; Glen Echo Electric Street Railway Company of Washington; Herkimer Paper Company; Howe, Brown & Company; Illinois Steel Company; Lehigh Avenue Passenger Electric Street Railway Company of Philadelphia; Lombard, Ayres & Company; McConway & Torley Company; McKeesport Electric Light Company; Metropolitan Electric Light Company of London; Missouri Electric Light & Power Company of St. Louis; Muncie Pulp & Paper Company; New England Dredging Company; Newton Paper Company; G. H. Nichols & Company; Ohio Paper Company; Oliver Oil Company; Omaha & Council Bluffs Electric Railway Company; Omaha Electric Street Railway Company; Otis Iron & Steel Company; Pacific Rolling Mill Company; Pencoyd Iron Works; Pennsylvania Steel Company; Philadelphia & Reading Coal and Iron Company; Pittsburgh Locomotive & Car Work; Robert Poole & Son Company; Quaker City Dye Works; St. Charles Car Works; Sawyer-Man Electric Company; Schenectady Locomotive Works; Williams Sellers & Company; Sherman Oil & Cotton Company; Shoenberger & Company; Southern Cotton Oil Company; Claus Spreckels' Sugar Refinery; Tacoma Light & Water Company; Terre Haute Electric Street Railway Company; Union Switch & Signal Company; United Electric Light & Power Company; Vancouver Electric Street Railway & Light Company; Wellman Iron & Steel Company; Westinghouse Air Brake Company; Westinghouse Electric & Manufacturing Company; Wilmington City Electric Street Railway Company.

Over 3000 other users.

THE WESTINGHOUSE MACHINE COMPANY.

BUILDERS' AGENCY PITTSBURGH. PENNA. U.S. OF A.

RETORTS AND FIRE BRICK.

J. H. GAUTIER & COMPANY

CORNER OF

GREENE AND ESSEX STREETS,

JERSEY CITY, N. J.

MANUFACTURERS OF

Clay Gas Retorts,

Gas House Tiles,

Fire Bricks, Etc. Etc.

Ground Clay, Fire Brick and Fire Sand in Barrels,

H. GAUTIER, Prest. CHAS. E. GAUTIER, Sec. & Treas.
CHAS. E. GREGORY, V.-Prest. DAVID R. DALY Gen'l Mang'r.

BROOKLYN

Clay Retort & Fire Brick Works,

(EDWARD D. WHITE & CO.)

Manufacturers of Clay Retorts, Fire Brick, Gas House and other Tile.

VAN DYKE, ELIZABETH, RICHARDS & PARTITION STS.

Office, 88 Van Dyke St., Brooklyn, N. Y.

RETORTS AND FIRE BRICK.

LACLEDE FIRE BRICK MFG. CO.,

MANUFACTURERS OF

Fire Brick, Gas Retorts,

AND

ST. LOUIS STANDARD SEWER PIPE.

Blast Furnace and Cupola Linings, every description of Fire Clay Material, Fire Clay Flue Linings, Chimney Tops Dry Milled and Crude Fire Clays, etc.

OFFICE AND DEPOT

901, 903, and 905 Pine Street,

ST. LOUIS, MO.

ESTABLISHED IN 1845.

B. KREISCHER & SONS,

OFFICE FOOT OF HOUSTON ST., E.R., N.Y.

Gas Retorts,

TILES, FIRE BRICK.

AND EVERYTHING IN THE FIRE CLAY LINE.

RETORTS AND FIRE BRICK.

MANHATTAN

FIRE BRICK & ENAMELLED CLAY

RETORT WORKS

ADAM WEBER.

CLAY GAS RETORTS AND RETORT SETTINGS

FIRE BRICKS, TILES, ETC.,

Office and Works, 15th Street and Avenue C., N. Y

Works, LOCKPORT STATION, PA.

—ESTABLISHED 1864.—

JAMES GARDNER, JR.,

Successor to WILLIAM GARDNER & SON.

Office, Rooms 19 & 20, Lewis Block PITTSBURGH, PA. P. O. Box 373

Fire Clay Goods for Gas Works.

SOLE REPRESENTATIVE OF THE McILHENNY REGENERATIVE BENCHES FOR THE U. S.

H. A. NORTON, No. 92 WATER STREET, BOSTON, MASS., Agent for the New England States.

HENRY MAURER & SON,

(ESTABLISHED 1856.)

EXCELSIOR FIRE BRICK & CLAY

RETORT WORKS

WORKS, Perth Amboy, N. J.

OFFICE, 418 to 422 East 23d St., N. Y.

Clay Gas Retorts,

BENCH SETTINGS,

Fire Brick, Tiles, Etc.

GEROULD'S IMPROVED RETORT CEMENT.

A Cement of great value for patching retorts, putting on mouth-pieces making up all bench-work joints, lining blast furnaces and cupolas. This cement is mixed ready for use. Economic and thorough in its work. Fully warranted to stick.

PRICE LIST.

In Casks, 600 to 800 lbs., f.o.b. N. Y., at 5 cents per pound.
In Kegs, 100 to 300 lbs., " " at 6 " "
In Kegs less than 100 lbs., " " at 7 " "

C. L. GEROULD & CO.,

5 & 7 Skillman St., Brooklyn, N. Y.

Western Agt., H. T. GEROULD, Jeffersonville, Ind.

Parker-Russell Mining and Mfg. Co.,

CITY OFFICE,

Mermod-Jaccard Bldg., Rooms 307 & 308, Broadway & Locust St., St. Louis. Mo.

PROPRIETORS OF THE

OAKHILL GAS RETORT & FIRE BRICK W'KS

Our immense establishment is now employed almost entirely in the manufacture of

Materials for Gas Companies

We have studied and perfected three important points. Our retorts are made to stand changes of temperature, the strongest heats of the furnace, and the abrasion of feeding and emptying We have the *exclusive Agency for the West* of the celebrated

Kloenne-Bredel Full Depth and Semi-Recuperator Benches,

And also furnish and build

Our Own Styles Semi-Recuperator Furnaces for the use of Coal or Coke as fuel.

THOS. SMITH, Prest. AUGUST LAMBLA, Vice-Prest. & Supt.

BALTIMORE

RETORT & FIRE BRICK CO.

MANUFACTORY AT

LOCUST POINT BALTIMORE, MD.

Clay Retorts, Blocks & Tiles

FIRE BRICK, FIRE CLAY, AND FIRE CEMENT.

Red and Buff Ornamental Tiles and Chimney Tops. Drain and Sewer Pipe (from 2 to 30 inches). Baker Oven Tiles 12x12x2 and 10x10x2.

WALDO BROS., 88 WATER ST., BOSTON, MASS

Sole Agents the New England States.

Boston Fire Brick Works Manufacturers of **Gas Retorts and Settings**

Under the Personal Supervision of MR. GEO. C. HICKS late of Chicago.

Fire Clay Goods of all kinds. Akron Sewer Pipe, Lime, Cement, etc. Agts. for the Arc Gas Lamp & Governing Gas Burners.

Send for Circulars and Prices to

FISKE, COLEMAN & CO., Managers, No. 62 Congress Street, Boston, Mass

FRED. BREDEL, C. E.,

Contractor for the Complete Erection and Equipment of Gas Works.

Sole Proprietor of the KLOENNE PATENTS for North America.

Gas Condensing and Purifying Machine.

Doing all the Work Between Exhauster & Oxide Purifier.

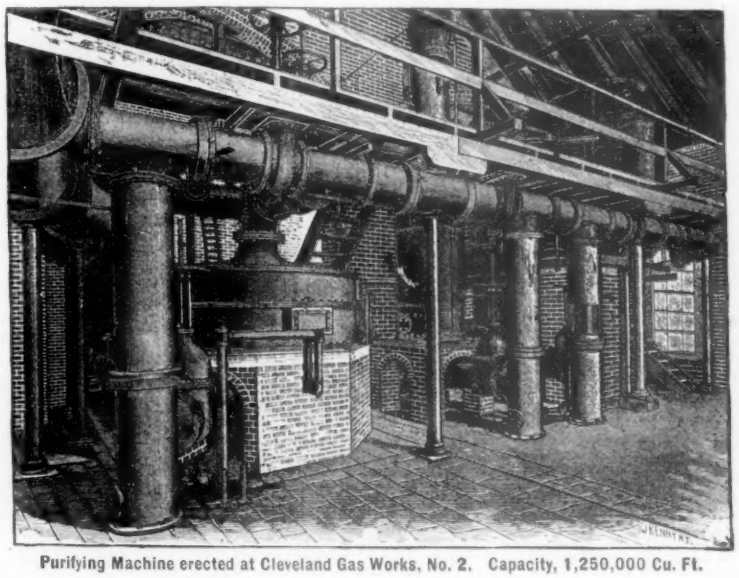
No Condensers Required.

No Naphthaline or Pitch is Formed.

HIGHER CANDLE POWER.

Tar & Ammonia Washers

WATER GAS WASHERS.



Purifying Machine erected at Cleveland Gas Works, No. 2. Capacity, 1,250,000 Cu. Ft.

RECUPERATIVE FURNACES.

Adapted to Retort Houses With or Without Stage Level.

Over 1,400 Retorts Now in Use in America.

Inclined Retort Benches.

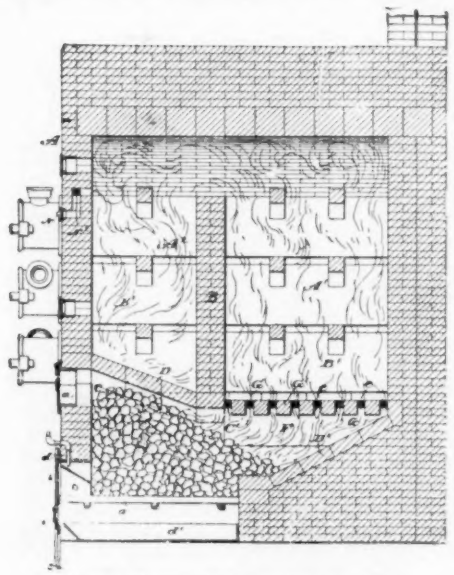
Refers, by permission, to Mr. Eugene Vanderpool, Newark, N. J., and Mr. E. G. Cowdery, Milwaukee, Wis.
For further information address

FRED. BREDEL,

118 Farwell Ave., Milwaukee, Wis. 22 Beaver St., N. Y. City.

FLEMMING'S

Generator-Gas Furnace



Materials furnished and Benches erected by

J. H. GAUTIER & CO., - Jersey City, N. J

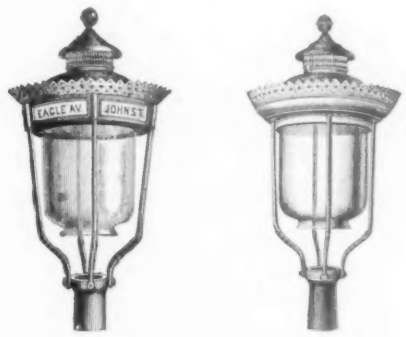
Address as above, or D. D. FLEMMING, Jersey City, N. J

AMERICAN GAS LIGHT JOURNAL

$3.00 per Annum.

A. M. CALLENDER & CO.,

32 Pine Street, N. Y.



The Miner Street Lamps.

Jacob G. Miner,

No. 823 Eagle Ave., New York, N. Y.

Bartlett Street Lamp Mfg. Co.

MANUFACTURERS OF

Globe Lamps,

FOR

Streets, Parks, Public Buildings, Railroad Stations, etc.

LAMP POSTS

A Specialty.

Office and Salesroom,

40 & 42 COLLEGE PLACE, - - N. Y. CITY.

Gas Companies and others intending to erect Lamps and Posts will do well to communicate with us.

The American Gas Engineer and Superintendent's Handbook.

By WM. MOONEY.

350 Pages, Full Gilt Morocco. Price, $3.00.

A. M. CALLLENDER & CO., 32 Pine St., N. Y.

DAVIS & FARNUM MFG. CO.,

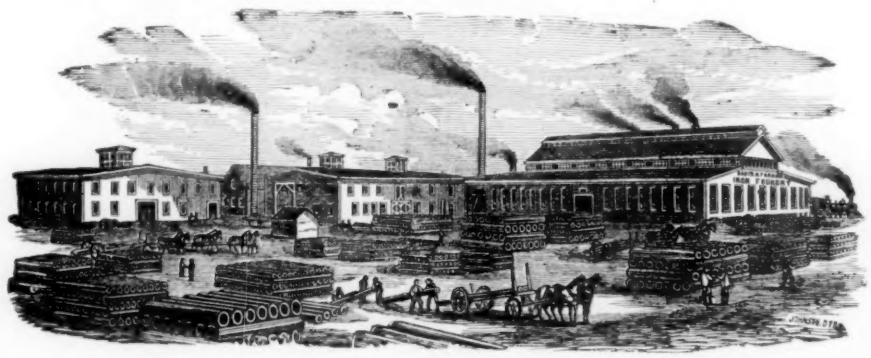
WALTHAM, MASS.

PRINCIPAL OFFICE AND WORKS, Waltham, Mass. BOSTON OFFICE, Room 18, Vulcan Building, 8 Oliver Street.

SINGLE, DOUBLE, AND TRIPLE LIFT

Gasholders.

OF ANY CAPACITY.



TUBULAR, PIPE, AND SINUOUS FRICTION

Condensers.

OF ALL SIZES.

IRON ROOF FRAMES AND FLOORS.

Purifying Boxes, Center Seal or Valve Connections, Bench Work.

Reversible Lime Trays.

SELF-SEALING AND PRESSED STEEL MOUTHPIECE LIDS.

Coke Barrows, Coal Wagons, and all Apparatus Requisite for a Complete Gas Plant.

— ALSO —

Gas and Water Pipe, Flanged Pipe,

Sugar House Work, and Special Castings of all Descriptions.

Established 1861. Incorporated 1881.

KERR MURRAY MFG. CO.,

FORT WAYNE, IND.

Those who are in need of

Holders or Gas Works Apparatus of any Description,

AND OF THE LATEST IMPROVEMENTS,

will find it to their interest to

GET AN ESTIMATE FROM US

before placing their order.

As we make a Specialty of this Class of Work, and are Practical Builders and Manufacturers of same,

with our long years of experience in the business,

WE CAN GUARANTEE YOU SATISFACTION.

Estimates, Plans and Specifications Furnished on Application.

BARTLETT, HAYWARD & CO.

Baltimore, Md.

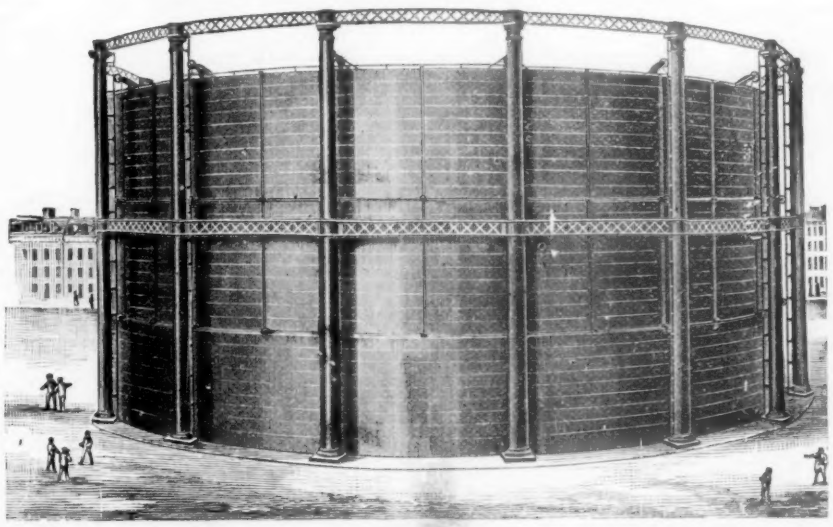
Triple Double, & Single-Lift
GASHOLDERS.

Iron Holder Tanks.

ROOF FRAMES.

Girders.

BEAMS.



PURIFIERS.

CONDENSERS.

Scrubbers.

BENCH CASTINGS.

OIL STORAGE TANKS.

Boilers.

The Wilkinson Water Gas Process.

THIRTY-CANDLE, NON-CONDENSABLE, FIXED GAS. THE MOST SUCCESSFUL GAS PROCESS IN OPERATION.

Munich Regenerative Furnace, System Drs. Schilling & Bunte.

MILL'S REVERSIBLE LIME TRAYS.

Gas Works Designed and Constructed.

Pascal Iron Works. ESTABLISHED 1821. Delaware Iron Works.

MORRIS, TASKER & CO.,

INCORPORATED.

OFFICE, 224 SOUTH THIRD STREET, - - PHILADELPHIA, PA.

CONTRACTORS, BUILDERS, AND MANUFACTURERS OF

Gas, Water & Sugar Works

Bench Castings.

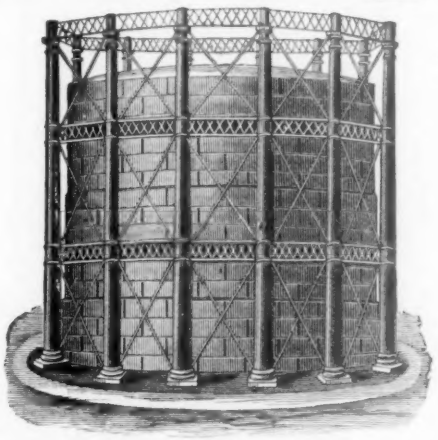
Condensers.

Scrubbers.

Purifiers.

Hyd. Carriages.

Iron Floors,



Iron Roofs.

Street Stops,

Valves, etc.

Stand-Pipes.

Water & Oil

Tanks, all Sizes.

Single, Double, and Triple-Lift Gas Holders.

SELF-SEALING RETORT LIDS. STAMPED STEEL RETORT LIDS.

Locomotive Water Columns, Filters, etc. Boiler Tubes, Wrought Iron Pipe & Fittings

Plans, Specifications and Estimates for all kinds of Machinery furnished on application.

Foundries & Works,
MILLVILLE, FLORENCE,
and CAMDEN, N. J.

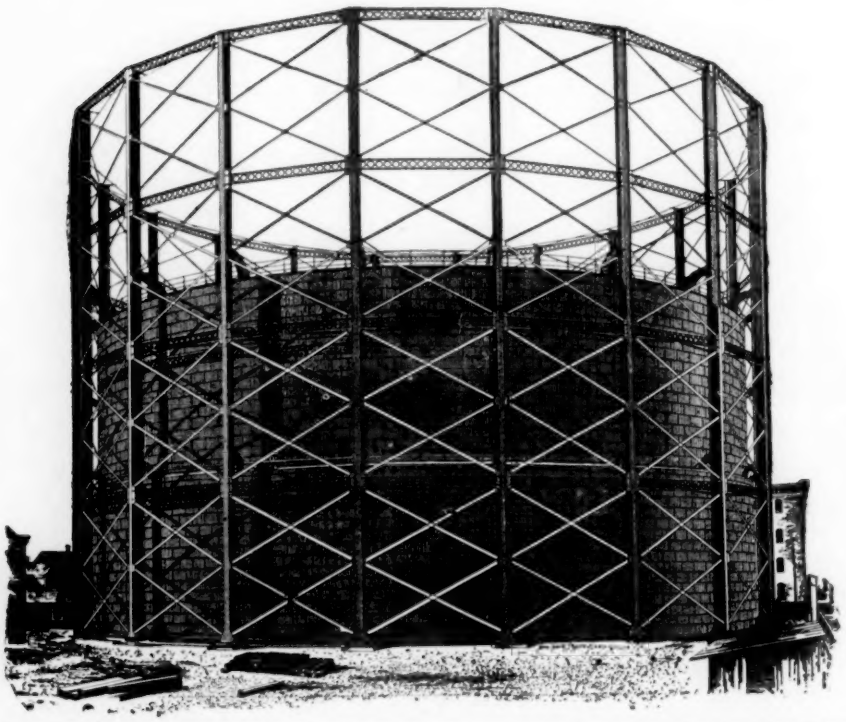
R. D. WOOD & CO.,

Engineers,
Iron Founders,
and
Machinists.

400 Chestnut St., PHILADELPHIA, PA.

MANUFACTURERS OF

CAST IRON PIPE,



Gas Holders,

SINGLE, DOUBLE, AND TRIPLE LIFTS, WITH
OR WITHOUT WROUGHT IRON
OR STEEL TANKS.

PURIFIERS, CONDENSERS.

Scrubbers.

BENCH WORK.

Iron Floors and Roofs, Plate Girders.

Heavy Loam Castings.

HYDRAULIC WORK.

Lamp Posts, Valves, Etc.

ISBELL-PORTER COMPANY,

G. G. PORTER, Prest. (Successors to SMITH & SAYRE MFG. COMPANY) CHAS. W. ISBELL, Secy.

ENGINEERS AND CONTRACTORS FOR THE

Construction and Extension of Gas Works.

Special Castings, Tees, Bends, etc.
Bench Castings.
Water Gas Generators.
Hydraulic Mains.
Iron Floors.
Brenner Self-Sealing Retort Lids.
Tar Gates and Hydraulic Main Dip Regulators.
Hutchison's Tar Displacement Apparatus.
Multitubular Condensers.
Standard Washer-Scrubbers.
Tower Scrubbers.
Walker's Tar and Carbonic Acid Extractors.
Exhausters.
Engines.
Steam Jet Exhausters.
Exhauster Governors.
Compensators.
Self-Acting Bye-Pass Valves.
Valves.
Valve Stands with Indicators.
Purifying Boxes.
Purifier Valve System.
Center Seals.
Street Governors.

Estimates, Drawings and Specifications Furnished for the Alteration, Improvement, or Extension of Existing Works or the Construction of New Works.

ISBELL-PORTER COMPANY,

No. 245 Broadway, New York City.

GAS WORKS APPARATUS AND CONSTRUCTION. GAS WORKS APPARATUS AND CONSTRUCTION.

JAMES R. FLOYD & SONS,

(SUCCESSORS TO HERRING & FLOYD)

Oregon Iron Works,

W. 20th & 21st. Sts., bet. 10th & 11th Avs.,

NEW YORK CITY.

Engineers and Contractors

FOR THE

CONSTRUCTION OF GAS WORKS.

MANUFACTURERS OF

All Kinds of Castings and General Ironwork

FOR

GAS APPARATUS.

Bench Castings, Regenerative and Half Regenerative Furnace Castings.

Condensers, Scrubbers, Purifiers, Street Drips and Connections,

Valves,

Hydraulic Hoisting Purifier Carriage, Self-Sealing Retort Lids, Improved Valve Stand and Indicator, Seller's Cement.

Plans, Specifications, and Estimates furnished for Construction of New or Alteration of Old Works.

Bouton Foundry Co.,

FOUNDERS AND MACHINISTS,

CHICAGO, ILL.

Gas Works Apparatus,

PURIFIERS, CONDENSERS,

Bench Work

SPECIALS. LAMP POSTS,

SCRUBBERS,

Iron Roofs and Floors.

Plans and Estimates furnished for new works or extensions of old works.

H. RANSHAW, Prest. & Mangr. WM. STACEY, Vice-Prest. T. H. BIRCH, Asst. Mangr. R. J. TARVIN, Sec. & Treas.

STACEY MFG. CO.,

MANUFACTURERS OF

Single and Telescopic Gasholders,

IRON ROOFS, BRIDGES, LAMP POSTS,

Water and Oil Tanks, Coal Elevator Cars,

COKE CRUSHERS, BENCH CASTINGS,

And all kinds of Wrought and Cast Iron Work used in the erection of Coal and Oil Gas Works Rolling Mill Machinery and Heavy Castings a Specialty.

Foundry: 33, 35, 37 & 39 Mill Street.

Wrought Iron Works: 16, 18, 20, 22, 24 & 26 Ramsey Street:

Cincinnati, Ohio.

1842. # DEILY & FOWLER, 1891

Laurel Iron Works.

Address, No. 39 Laurel Street, Philadelphia, Pa.

BUILDERS OF

GASHOLDERS,

Single and Telescopic.

Holders Built 1885 to 1890, Inclusive

Omaha, Neb.	Port Chester, N. Y.	Paducah, Ky.	Tacony, Pa. (two)	Central Gas Lt. Co., New York City (2d)
Scranton, Pa. (2d)	New Rochelle, N. Y.	Norwich, Conn.	Mount Vernon, N. Y.	
Long Island City, N. Y.	Salem, N. J. (3d)	Seattle, W. T.	Binghamton, N. Y.	Tacoma, Wash.
Macon, Ga.	Omaha, Neb. (2d)	San Diego, Cal.	Concord, N. H.	Knoxville, Tenn.
York, Pa.	Lynn, Mass. (2d)	Northern Gas Lt. Co., of New York, N. Y.	Dover, Del. (2d)	Pottstown, Pa.
Chester, Pa.	Little Rock, Ark.	Westerly, R. I.	Calais, Me.	Victoria, B. C.
Hazleton, Pa. (2d.)	Irvington, N. Y.	Willimantic, Conn	New London, Conn. (2d)	Vancouver, B. C.
Staten Island, N. Y.	South Boston, Mass.	Montclair, N. J.	West Chester, N. Y.	Charlottesville, Va.
Saugerties, N. Y.	Rye, N. Y. (2)	Attleboro, Mass.	Bay Shore, L. I.	So. Framingham, Mass.
Clinton, Mass. (Lan. Mills)	Woodstock, Ont.	Santa Cruz, Cal.	Washington, D. C.	Woonsocket, R. I.
Chattanooga, Tenn.	Malden, Mass.	Erie, Pa. (2d)	Newport, R. I. (2d)	Simcoe, Can.
Galveston, Texas. (3d.)	Staten Island, N. Y. (2d)	West Chester, Pa. (2d	Morristown, N. J.	Pittsfield, Mass. (2d)
Fort Plain, N. Y.	Woodstock, Ont.	Lancaster, Pa. (3d	Lebanon, Pa.	Chattanooga, Tenn. (2d)
Brunswick, Ga.	Malden, Mass.		Oakland, Cal.	

PATENTS.

FRANKLIN H. HOUGH

Solicitor of American & Foreign Patents.

925 F. ST., WASHINGTON, D. C.

(NEAR U. S. PATENT OFFICE.)

Personal attention given to the preparation and prosecution of applications for Letters Patent. All business before the U. S. Patent Office attended to for moderate fees. **No Agency in the United States possesses superior facilities for obtaining Patents,** or for ascertaining the patentability of inventions. Copies of patents furnished for 25 cents each. Correspondence solicited.

GREENOUGH'S

"DIGEST OF GAS LAW."

Price, $5.00.

This is a valuable and important work, a copy of which should be in the possession of every gas company in the country, whether large or small. As a book of reference it will be found invaluable. It is the only work of the kind which has ever been published in this country, and is most complete. Handsomely bound. Orders may be sent to

A. M. CALLENDER & CO., 32 Pine St., N. Y.

WM. HENRY WHITE,

No. 32 Pine Street, - - - New York City.

ENGINEER AND CONTRACTOR FOR THE

ERECTION AND EXTENSION OF

GAS, WATER, AND ELECTRIC LIGHT WORKS.

Correspondence with Gas Companies contemplating extending or improving their Plants respectfully invited.

Plans and Estimates Furnished.

GAS COALS. CANNEL COALS. GAS ENRICHERS.

JAMES D. PERKINS. **PERKINS & CO.,** F. SEAVERNS.

228 & 229 Produce Exchange, New York.

Cable Address, "PERKINS, NEW YORK." Post Office Box 3695, New York.

GENERAL SALES AGENTS FOR

The Youghiogheny River Coal Company's

OCEAN MINE YOUGHIOGHENY GAS COAL.

HON. W. L. SCOTT, Prest. M. H. TAYLOR, Vice-Prest.

This Colliery is located at **SCOTT HAVEN, PA.**, in the center of the Youghiogheny Gas Coal District, and produces the **ONLY RELIABLE YOUGHIOGHENY COAL** for gas purposes. (See Map on p. 87 of this JOURNAL, Feb. 16, '85.)

POINTS OF SHIPMENT,

Locust Point, BALTIMORE. Pier No. 62, PHILADELPHIA.

ST. GEORGE, STATEN ISLAND, N. Y. HARBOR.

Also, Shippers of the following well-known Cannels:

Breckenridge & Old Kentucky Boghead from Kentucky,

AND THE

JELLICO CANNEL, from TENNESSEE.

Within the past four years we have delivered these Cannels to over One Hundred and Fifty Gas Companies in Thirty-five different States, and to some of the largest Gas Companies in

GREAT BRITAIN, ON THE CONTINENT, AND SOUTH AMERICA.

Single carloads or more delivered at any required point in the United States and Canada. Cargo shipments from

NEW YORK, PHILADELPHIA, BALTIMORE, NORFOLK, AND NEWPORT NEWS.

Particulars as to prices, etc., furnished upon application to the above address.

JAMES & WILLIAM WOOD,

Gas and Cannel Coal Contractors,

No. 40 St. Enoch Sq., Glasgow. No. 2 Talbot Court, London.

Proprietors of the **BATHVILLE COLLIERIES** (which produce the celebrated **BOGHEAD CANNEL**), Shields, Shieldmuir, Drumpeller, and other Collieries. This Firm offer

STANDARD CANNELS,

Unequaled as Gas Enrichers.

Analyses, prices, and all further information furnished on application to

Agency for U. S., Room 70, Nos. 2 & 4 Stone St., N.Y. City.

Established 1860.

CAESAR BROS.,

MANUFACTURERS OF

ENAMELED

Gas, Water Meter, and Clock

DIALS.

ALSO,

Enameled Iron Plates in Colors, and the Patent Enameled Letters and Numbers.

We make a specialty of this class of work, and, with our long experience of over 20 years, can guarantee not only satisfaction and correctness, but extremely low quotations. ESTIMATES AND SAMPLES FURNISHED ON APPLICATION.

Office & Salesrooms, 11 Park Row, N. Y.

Factory, 153, 155, 157, 159 West Avenue, Hunter's Point, L. I., N. Y.

COKE CRUSHERS.

The Despard Gas Coal Co.,

MINERS AND SHIPPERS OF

DESPARD GAS COAL,

AND MANUFACTURERS OF

COKE.

MINES, Clarksburg, Harrison Co., W. Va.
WHARVES, Locust Point, Baltimore, Md.
OFFICE, 44 South Street, Baltimore, Md

ROUSSEL & HICKS, 71 Broadway, N. Y. } AGENTS. { BANGS & HORTON, 60 Congress St., Boston

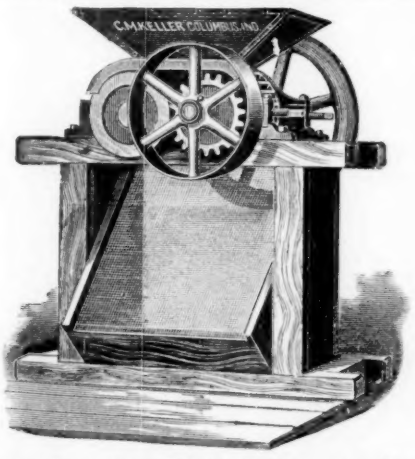
COXE BROS. & CO.

Cross Creek, Sugar Loaf & Beaver Meadow Lehigh Coals.

General Office, 143 Liberty St., New York.

Boston, 70 Kilby Street; Phila., 420 Walnut Street; Chicago, "The Rookery"; Buffalo, Coal and Iron Exchange; Milwaukee, 91 Michigan Street.

E. B. ELY, Gen'l Agent.



Keller's Adjustable Coke Crusher.

SIMPLE, STRONG, AND DURABLE.

C. M. Keller, Sec. & Supt. Gas Lt. & Coke Co. Columbus, Ind.

Correspondence Solicited.

Electric Light Primer.

BY CHARLES L. LEVEY.

A simple and comprehensive Digest of all the most important facts connected with the running of the Dynamo and Electric Lights, with Precautions for Safety, etc.

Price, 50 cents.

A. M. CALLENDER & CO., 32 Pine St., N.Y.

GAS COALS.

GAS COALS.

THE PENN GAS COAL CO.

OFFER THEIR

Coal, Carefully Screened & Prepared for Gas Purposes.

Their Property is located in the Youghiogheny Coal Basin, near Irwin and Penn Stations on the Pennsylvania Railroad, and on the Youghiogheny River.

Principal Office:

209 SOUTH THIRD STREET, PHILA., PA.

Points of Shipment:

Pennsylvania Railroad Piers; Greenwich Wharves, Delaware River; Pier No. 1 (Lower Side), South Amboy, N. J.

Chesapeake & Ohio Railway Coal Agency;

FOR THE SALE OF THE

Superior Kanawha Gas Coals, Cannelton Cannel,

Also, SPLINT AND STEAM COALS

From the Kanawha and New River Regions, on the line of the Chesapeake & Ohio R'way.

C. B. ORCUTT, General Agent, - - No. 1 Broadway (Room 217) New York City

EDMUND H. MCCULLOUGH, Prest CHAS. F. GODSHALL, Treas. H. C. ADAMS, Sec.

THE WESTMORELAND COAL CO.

Chartered 1854.

Mines situated on the Pennsylvania and the Baltimore and Ohio Railroads, in Westmoreland County, Penn.

POINTS OF SHIPMENT:

PHILADELPHIA, BALTIMORE, SOUTH AMBOY, N. J.
WATKINS (SENECA LAKE), N. Y.

Since the commencement of operations by this Company its well-known Coal has been largely used by the Gas Companies of New England and the Middle States, and its character is established as having no superior in gas-giving qualities, and in freedom from sulphur and other impurities.

Principal Office, 224 South 3d St., Phila., Pa.

THE CLERK GAS ENGINE CO.,

Main Office, 1012, 1014, 1016, 1018 Filbert St., Philadelphia, Pa.

WM. W. GOODWIN, Prest. E. STEIN, Sec.

The utility and convenience of the Gas Engine being no longer an open question, it only remains now for intending purchasers to select the BEST. We claim for the CLERK GAS ENGINE that it is equal to any other manufactured as regards steadiness in running, simplicity, and ease of keeping in repair, and that it gives the greatest amount of power for the least money (both in first cost and expense of running) of any engine made. In support of this claim we refer to the test of the Gas Engines made under the direction of the American Institute of New York in December, 1885, and heretofore published in these columns. These engines are especially adapted for continuous running under heavy loads, and we can refer to Engines which have run 22 hours a day for months at a time.

Made in Sizes of 5 10 15 20, and 25 Horse Power. All Engines Guaranteed for One Year.

JOHN J. GRIFFIN & CO.,

Nos. 1513, 1515, 1517 & 1519 Race Street, PHILADELPHIA.
52 Dey St., NEW YORK. 75 N. Clinton St., (FRED. R. PERSONS, Mangr.) CHICAGO.

MANUFACTURERS OF

METERS FOR MEASURING GAS

IN ANY VOLUME.

Provers, Gauges, Registers, Etc., Etc.

EXPERIMENTAL APPARATUS FOR QUANTITATIVE AND QUALITATIVE ANALYSIS.

Careful and Prompt Attention paid to Repairing of all kinds of Meters and Apparatus.

Estimates Cheerfully Furnished.

Dry Gas Meters.

With 40 years' experience and the best facilities for manufacturing, is enabled to furnish reliable work and answer orders promptly.

NATHANIEL TUFTS,

No. 153 Franklin Street, Boston, Mass.,

MANUFACTURER OF

DRY GAS METERS.

Station Meters of any Capacity.

Test and Experimental Meters, Pressure Registers, Pressure Gauges Pressure and Vacuum Gauges.

METER PROVERS, PHOTOMETERS, STREET LANTERNS, ETC., ETC.

Patent Cluster Lanterns for Street Illumination.

CHARLES E. DICKEY. JAMES B. SMALLWOOD. CHARLES H. DICKEY.

THE MARYLAND METER AND MANUFACTURING CO.

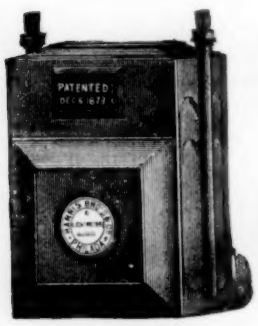
Established 1866.

BALTIMORE, North & Saratoga Sts. **CHICAGO, 122 & 124 Michigan St.**
NEW YORK, 838 Broadway. **SAN FRANCISCO, 221 Front St.**
BOSTON, 92 Water Street, Rooms 21 and 22.

CONSUMERS' & STATION METERS, PRESSURE GAUGES, Etc., Etc.

"Success" and "Perfect" Gas Stoves.

A. HARRIS. E. L. HARRIS. J. A. HARRIS.



Established 1849.

HARRIS BROS. & CO.,

Twelfth and Brown Streets, Philadelphia.

Manufacturers of Wet and Dry Gas Meters,

STATION METERS, METER PROVERS,

EXPERIMENTAL METERS, SHOW OR GLAZED METERS.

Pressure and Vacuum Registers, Gauges, Photometers, Drip and Bell Pumps, Etc., Etc.

PROMPT ATTENTION GIVEN TO ALL ORDERS. METERS THOROUGHLY REPAIRED. ESTIMATES FURNISHED FOR STATION METERS OF ALL SIZES. CORRESPONDENCE SOLICITED.

GAS METERS. GAS METERS. GAS METERS.

GEO. J. McGOURKEY, Prest. WM. H. McFADDEN, Vice-Prest. (Phila.) WM. N. MILSTED, Gen. Supt. and Treas. (New York). WM. H. DOWN, Sec.

THE AMERICAN METER CO.

Established 1834. Incorporated 1863.

WET AND DRY GAS METERS. PRESSURE REGISTERS. METER PROVERS.
STATION METERS. PRESSURE & VACUUM REGISTERS. PORTABLE TEST METERS.
EXHAUSTER GOVERNORS. PRESSURE & VACUUM GAUGES. EXPERIMENTAL METERS.
DRY CENTER VALVES. CRESSON GAS REGULATORS. AMMONIA TEST METERS.
GOVERNORS FOR GAS WORKS. MARSLAND WATER METERS. BAR & JET PHOTOMETERS.

Manufactories:
512 West 22d St., N. Y.
Arch & 22d Sts., Phila.

GAS STOVES.
SUGG'S "STANDARD" ARGAND BURNERS,
SUGG'S ILLUMINATING POWER METER,
Wet Meters, with Lizar's "Invariable Measuring" Drum.

Agencies:
177 Elm Street, Cincinnati.
244 & 246 N. Wells Street, Chicago.
810 North Second Street, St. Louis.
222 Sutter Street, San Francisco.

HELME & McILHENNY,

(Established 1848.)

GAS METER MANUFACTURERS,

Nos. 1339 to 1349 Cherry Street, Philadelphia, Pa.,

WET AND DRY GAS METERS. STATION METERS, EXPERIMENTAL METERS, METER PROVERS,

Center Seals, Pressure Registers, Governors, Indicators, Photometers, and all other kinds of Apparatus for use in Gas Works.

FOULIS' PATENT STATION AND DISTRICT GOVERNORS.

REPAIRING DEPARTMENT.—We employ a special force of skilled workmen repairing meters of **all makers.**

D. McDONALD & CO.,

GAS METER MANUFACTURERS.

(Established 1854.)

51 Lancaster St., Albany, N. Y. 34 & 36 West Monroe St., Chicago, Ill.

STATION METERS, EXPERIMENTAL METERS, METER PROVERS, PRESSURE & VACUUM REGISTERS, PRESSURE GAUGES, ETC.

We use only the very best materials, and employ the most skilled labor, and by our long experience (37 years) and personal supervision of every deta we feel justified in assuring the public that our goods will give perfect satisfaction. Every Meter emanating from our establishment will bear the Sta Inspector's Badge, and will be fully warrented by us. Our Annual and Calendar will be sent to Gas Companies upon applicatio.

Other people have found us to
their advantage.
We'll be glad to serve you.

STATION METERS.
METER PROVERS.
CONSUMERS' METERS
REPAIRING.

W. WALLACE GOODWIN, President. E. STEIN, Vice-President. WM. E. STEEN, Sec. & Treas. H. B. GOODWIN, Superintendent.

THE GOODWIN GAS STOVE AND METER COMPANY,

1012, 1014 & 1016 Filbert Street, Philadelphia, Pa.

113 Chambers St., N. Y. 44 & 46 Dearborn St., Chicago. Agts., Waldo Bros., 88 Water St., Boston.

SOLE MANUFACTURERS OF THE

"Sun Dial" Gas Stoves,

IN A GREAT VARIETY OF STYLES AND SIZES.

Gas Cooking Stove No. 7C.

The Most Economical, Efficient, and Durable Gas Stove Made.

SIZE.

Stove.	*Oven.*	*Broiler.*	*Top.*
31 inches high.	9¾ inches high.	10 inches high.	inches high.
17 inches wide.	15 inches wide.	15 inches wide.	16 inches wide.
	12½ inches deep.	12½ inches deep.	
	Length over extension shelves, 32 inches.		

This Stove has three Boiling Burners in the Top or Hot Plate, and single Oven Burner.

The consumption of this Stove is 35 cubic feet per hour, at 1½ inch pressure with all burners.

Three-eighth inch supply pipe should be used when the pressure is 1½ inches or over.

ALL FITTINGS ARE NICKEL PLATED.

Catalogue showing Styles and Prices sent free on application.

DRY and WET GAS METERS

Station Meters (square, cylindrical, or in staves), Glazed Meters, King's and Sugg's Experimental Meters, Lamp Post Meters, etc., etc.

METER PROVERS (Sizes 2, 5 and 10 feet.)

Pressure Gauges of all kinds, Pressure Registers, Pressure and Vacuum Registers, Pressure Indicators (sizes 4, 6 and 9 in.), King's Pressure & Vacuum Gauges.

DRY & WET CENTER SEALS, DRY & WET GOVERNORS, EXHAUSTER GOVERNORS.

Photometers of all descriptions. Letheby's Sulphur and Ammonia Test Apparatus Complete.

Also, TESTING AND CHEMICAL APPARATUS OF ALL KINDS, AND OF THE MOST PERFECT DESCRIPTION FOR ALL PURPOSES RELATING TO GAS.

GOODWIN'S IMPROVED LOWE'S JET PHOTOMETER.

Agents for Bray's Patent Gas Burners and Lanterns.

Special attention to Repairs of Meters [illegible] Apparatus connected with the business. All work guaranteed first class in every particular. Orders filled promptly.